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Corporate publications are program or department brochures, newsletters, pamphlets, and miscellaneous information about the RAND Corporation or RAND's business units. Some corporate publications are published in the AR series as Annual Reports or as Administrative Reports. Administrative Reports are often required by the client or sponsor and provide a status report on work resulting from a contract.

RAND ARROYO CENTER

Annual Report 2011

For more than 60 years, the RAND Corporation has worked side by side with government as a trusted adviser. Through rigorous and objective research and the development of sophisticated analytic tools, RAND researchers from diverse disciplines and perspectives collaborate to create strategies and solutions to keep our nation strong.

RAND ARROYO CENTER

Annual Report 2011

Message from the Director

In January 2012, President Obama and Secretary Panetta issued the defense priorities for the United States.[1] The directive reasserts America's national security interests: the security of the nation and its allies and partners, the prosperity that flows from an unfettered international economic system, and a just and sustainable international order.

But the challenges to realizing these interests are many. Although al-Qa'ida has sustained grievous damage, it and its affiliates remain a threat. The Arab Spring has toppled dictators in the Middle East, but how those revolutions will play out remains unknown. Iran continues to pose a destabilizing threat to its region, including Iraq and traditional friends in the Persian Gulf. North Korea continues its belligerent posture toward South Korea and works to expand its nuclear weapons program—while a new leader attempts to take charge and economic collapse seems imminent. At home, we face hard fiscal realities that will continue to put pressure on military budgets.

It is RAND Arroyo Center's mission to provide the high-quality, objective analyses that will help the U.S. Army meet these challenges smartly and successfully.

Arroyo's **Strategy, Doctrine, and Resources Program** is characterizing potential future challenges—including the prospects for conflict with China—and identifying the capabilities needed to defeat hybrid adversaries. In addition, the program is looking at ways to make the Army more effective and efficient—for example, by analyzing the Active Component/Reserve Component mix and the Generating Force.

Arroyo's **Manpower and Training Program** is exploring effective and efficient ways to shape the Soldiers and leaders of the future force, while improving their training, well-being, and deployability. At the same time, the program is studying how to best employ the Army's civilian workforce.

Arroyo's **Force Development and Technology Program** evaluates new operational concepts and technologies. Examples include new concepts for cyber operations and for countering enemy anti-access and area-denial threats. The program also seeks optimal ways to equip the force given alternative readiness strategies, and it evaluates new technologies—such as those that enhance the effectiveness of tactical small units.

The **Military Logistics Program**'s work focuses on increasing the efficiency of the Army's logistics enterprise. Projects are under way to review dormant inventory and eliminate excess; improve the Army's end-to-end supply chain; find potential savings in equipment support costs; and balance logistics support provided by contractors with work performed at the Army's own depots.

Tim Bonds
is the Director of RAND Arroyo Center.

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[1] U.S. Department of Defense, *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense*, Washington, D.C., January 2012.

The well-being of Soldiers and their families remains a fundamental concern of the Department of Defense and the Army. Arroyo's **Military Health Program** is examining ways to assist Soldiers who have been wounded or injured, or have become ill, including their transition into health care systems outside the Army. It has also been scrutinizing the implications of long deployments for unit effectiveness and individual well-being.

The pages that follow in this Annual Report offer many examples of Arroyo's capabilities and expertise drawn from work conducted for the Army's leadership in fiscal year 2011. As RAND Arroyo Center enters its third decade of partnership with the Army, it stands ready to contribute its seasoned and specialized support. As the Army adapts its policies, processes, and practices to meet ever-evolving challenges, we will bolster those efforts by ensuring that timely, high-quality studies are available to inform needed change.

Tim Bonds
Director, RAND Arroyo Center

Contents

RAND Arroyo Center Overview

Mission and Contributions

Founded in 1982, RAND Arroyo Center is the United States Army's sole federally funded research and development center (FFRDC) for studies and analysis.[2] As an FFRDC, Arroyo enables the Army to maintain a strategic relationship with an independent, nonprofit source of high-quality, objective analysis that can sustain deep expertise in domains of direct relevance to perennial Army concerns. RAND Arroyo Center's mission is to:

- Conduct objective analytic research on major policy concerns, with an emphasis on mid- to long-term policy issues.
- Help the Army improve effectiveness and efficiency.
- Provide short-term assistance on urgent problems.
- Be a catalyst for needed change.

Arroyo investigates the full range of Army issues and aims to:

- Adapt to change and get out ahead of some of the changes in the world affecting the Army.
- Define innovative and different ways of operating.
- Maintain objectivity and balance in addressing controversial and sensitive subjects.
- Make unique contributions to the Army's key areas of interest.

Oversight

The Army's oversight and management of RAND Arroyo Center is stipulated by Army Regulation 5-21.[3] The regulation establishes a governing board of Army leaders known as the Arroyo Center Policy Committee (ACPC). Chaired most recently by the Under Secretary of the Army, the ACPC comprises the senior Army civilian and uniformed leadership. Fiscal year 2011 members are listed to the right. The Director for Program Analysis and Evaluation serves as Executive Agent for RAND Arroyo Center, charged with oversight of its daily operations.

The ACPC meets at least twice a year with Arroyo management to provide overall guidance, review the annual research plan, and approve individual projects. Additionally, each project is sponsored by at least one Army senior leader, either a general officer or a member of the Senior Executive Service. The sponsor has responsibility for helping to formulate the project, providing access to needed data and other information, monitoring its progress, reviewing its publications for accuracy, utilizing its findings, and implementing its recommendations.

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[2] Originally established at the Jet Propulsion Laboratory in Pasadena, California, the Arroyo Center was moved to RAND in 1984 at the request of the Chief of Staff of the Army.

[3] www.apd.army.mil/pdffiles/r5_21.pdf

The Arroyo Center Policy Committee

The Honorable Dr. Joseph W. Westphal, Under Secretary of the Army, chaired the September 16, 2011, meeting of the ACPC.

General Peter W. Chiarelli (Co-Chair)
Vice Chief of Staff, U.S. Army

Honorable Heidi Shyu (Co-Chair)
Assistant Secretary of the Army (ALT)(A) and Army Acquisition Executive

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General Robert W. Cone
Commanding General, U.S. Army Training and
Doctrine Command

General Ann E. Dunwoody
Commanding General, U.S. Army Materiel Command

General David M. Rodriguez
Commanding General, U.S. Army Forces Command

Lieutenant General Benjamin C. Freakley
Commanding General, U.S. Army Accessions Command

Lieutenant General John F. Mulholland, Jr.
Commanding General, U.S. Army Special Operations
Command

Lieutenant General Eric B. Schoomaker
Commanding General, U.S. Army Medical Command/
The Surgeon General

Lieutenant General Jack C. Stultz, Jr.
Chief, Army Reserve and Commanding General,
U.S. Army Reserve Command

Lieutenant General Thomas P. Bostick
Deputy Chief of Staff, G-1, U.S. Army

Lieutenant General John F. Campbell
Deputy Chief of Staff, G-3/5/7, U.S. Army

Lieutenant General Susan S. Lawrence
Chief Information Officer/G-6, U.S. Army

Lieutenant General Mary A. Legere
Deputy Chief of Staff, G-2, U.S. Army

Lieutenant General Robert P. Lennox
Deputy Chief of Staff, G-8, U.S. Army

Lieutenant General Rick Lynch
Assistant Chief of Staff for Installation Management/
Commanding General, Installation Management
Command, U.S. Army

Lieutenant General Raymond V. Mason
Deputy Chief of Staff, G-4, U.S. Army

Honorable Thomas R. Lamont
Assistant Secretary of the Army (Manpower and
Reserve Affairs)

Honorable Mary Sally Matiella
Assistant Secretary of the Army (Financial
Management and Comptroller)

Mr. Terrence C. Salt
Principal Deputy Assistant Secretary of the Army
(Civil Works)/Deputy ASA (Legislation)

Executive Agent for RAND Arroyo Center
Major General Joseph E. Martz
Director, Program Analysis and Evaluation

Membership effective December 2011.

Agenda Development

To help assure the usefulness and relevance of each study, the process by which it is formulated involves a high degree of interaction and coordination between the Army sponsors and the Arroyo research managers and project leaders. As the figure below shows, the process for developing an annual research agenda for core studies starts in early spring and concludes in September before the beginning of the fiscal year in which the studies will be initiated. Arroyo's Executive Agent sends a memorandum to the ACPC members soliciting study proposals. Shortly thereafter, Arroyo's leadership team begins discussing research ideas with sponsors.

The number of proposals typically greatly exceeds the number of studies for which funds are available. Individually and as a group, the proposals are evaluated within the context of criticality to the Army; available funding; and Arroyo's mission, available expertise, and comparative advantage to conduct the research. A portion of core funding is reserved to address important issues that may emerge during the final stages of research planning. In its fall meeting, the ACPC approves the research agenda of core projects for the upcoming fiscal year.

An Army leader can sponsor additional studies during the course of the year. The Executive Agent approves add-on projects. Studies may be added to the research agenda at any point during the fiscal year so long as Arroyo's total level of effort for the year does not exceed a ceiling established by the Office of the Secretary of Defense.

RAND Arroyo Center Works Closely with Army Leadership to Develop the Research Agenda
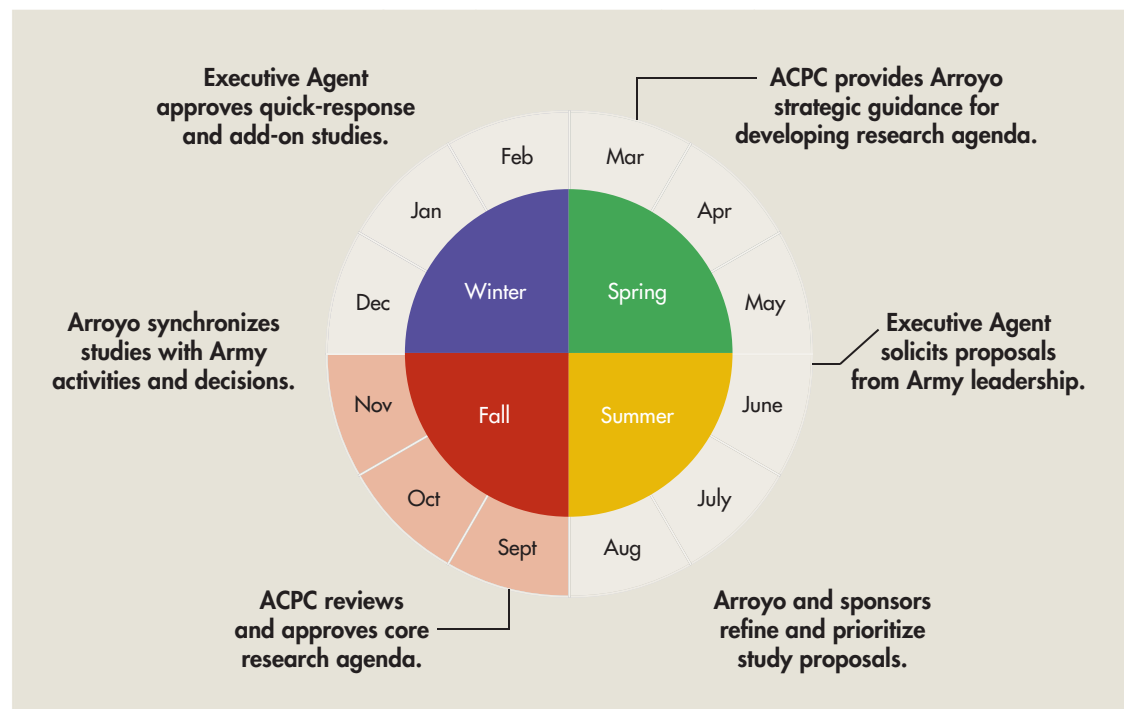
Research Products and Services

RAND Arroyo Center provides Army leadership with research products and services in four major categories, as listed in the table below: studies and analyses, education and training, subject matter experts, and research capital.

RAND Arroyo Center Research Products and Services

Studies and Analyses	Research Capital
Research programs on enduring challenges Quick-response studies to address emerging issues	Monthly research highlights Publications and summaries Website
Education and Training	**Subject Matter Experts**
Army Fellows Program Temporary assignments	Tailored briefings and seminars Embedded analysts

This annual report provides information on how RAND Arroyo Center delivered these products and services in fiscal year (FY) 2011:

- For an overview of FY11 "Studies and Analyses" (the first quadrant in the table) see Section 2, which explains the process by which studies are created and lists the FY11 studies in each of Arroyo's five programs.
- For examples of "Research Capital" see Section 3, which spotlights eight studies representing a cross-section of Arroyo's research agenda.
- For a better understanding of "Training and Education" activities see Section 4, which describes opportunities for mid-level Army officers to serve one-year terms at Arroyo, focusing on the background and contributions of officers participating in 2010–11.
- For a selection of "Subject Matter Experts" see Section 5, which profiles twelve researchers who made important contributions to Arroyo studies in FY11.

Management and Organization

At RAND, Arroyo is managed within the Army Research Division, one of RAND's largest research units. Arroyo organizes its work for the Army into five research programs, as depicted in the organizational chart on page 12.

Bruce Held
is the Deputy Director of RAND Arroyo Center.

Marcy Agmon
is the Operations Director of RAND Arroyo Center.

Arroyo Center Management Team

Tim Bonds
VICE PRESIDENT, ARMY RESEARCH DIVISION
DIRECTOR, RAND ARROYO CENTER

Bruce Held
DEPUTY DIRECTOR, RAND ARROYO CENTER

Marcy Agmon
DIRECTOR OF OPERATIONS

Strategy, Doctrine, and Resources	**Manpower and Training**	**Force Development and Technology**	**Military Logistics**	**Military Health Policy Research**[4]
Laurinda L. Rohn	**Michael Hansen**	**Christopher G. Pernin**	**Kenneth J. Girardini**	**Terri Tanielian**
DIRECTOR	DIRECTOR	DIRECTOR	DIRECTOR	DIRECTOR

[4] Research in this program is conducted through the Center for Military Health Policy Research, in collaboration with RAND Health, another unit of the RAND Corporation.

FY 2011 Research Agenda

- Strategy, Doctrine, and Resources Program

- Manpower and Training Program

- Force Development and Technology Program

- Military Logistics Program

- Military Health Program

- Quick-Response Studies

Strategy, Doctrine, and Resources Program

Laurinda L. Rohn
directs the Strategy, Doctrine, and Resources Program.

Mission and Research Streams

THE STRATEGY, DOCTRINE, AND RESOURCES PROGRAM, directed by Dr. Lauri Rohn, analyzes the dynamic security environment and its implications for future strategic concepts, Army roles and missions, force structure, capabilities, doctrine, and resourcing requirements.

The program sustains research streams in six policy domains:

- Assessing the evolving operating environment
- Developing capabilities to face new challenges
- Developing partner capabilities
- Improving resource management
- Learning from past and present operations
- Supporting Army wargames and analysis

Maintaining expertise in these domains also allows the program to provide timely short-term assistance on issues of importance to the Army.

The program's FY11 studies within these streams are listed to the right.

Sponsors of Strategy, Doctrine, and Resources Program Studies

Studies in the Strategy, Doctrine, and Resources Program are sponsored by a wide variety of senior Army leaders. The table below lists the military and civilian leadership that sponsored one or more studies in the program in FY11. A study may be jointly sponsored by two or more leaders.

The Army G-8 and U.S. Army Training and Doctrine Command are the most frequent sponsors of studies in the program. Other frequent sponsors include the Army G-3/5/7, the U.S. Army Special Operations Command, and the Center for Army Analysis.

Sponsors of FY11 Studies in Strategy, Doctrine, and Resources

- Office of the Under Secretary of the Army
- U.S. Army Training and Doctrine Command
- U.S. Army Special Operations Command
- Deputy Chief of Staff, G-3/5/7, U.S. Army
- Deputy Chief of Staff, G-8, U.S. Army
- Director, Army National Guard
- Center for Army Analysis

Research Agenda FY11
Selected Projects

Assessing the Evolving Operating Environment

- Understanding the Army's Potential Contributions to U.S. Success in Afghanistan-Pakistan, Phase II

- Improving the Understanding of the Environment of Irregular Warfare

- China: Prospects and Potential Outcomes

Developing Capabilities to Face New Challenges

- Building and Sustaining Resilient Clandestine Networks

- Enhancing the Contributions of Army National Guard Special Forces

- A Capabilities-Based Assessment of Sociocultural Requirements Across All Phases of Military Operations

- Improving Army Security Cooperation Planning and Programming

- Army National Guard Sourcing of Future Requirements for Stability Operations Capabilities

Improving Resource Management

- Transforming Business Operations of the U.S. Army

- Assessing the Army Generating Force

- Reassessing the Army's Force Mix: Providing Needed Forces While Reducing Costs

Learning from Past and Present Operations

- Improving Data Collection to Inform Future Operations

- The Battle of Sadr City: Lessons for Future Operations

- Improving the Army's Disaster Response: Lessons from the Earthquake in Haiti

Supporting Army Wargames and Analysis

- Joint Integrated Contingency Model (JICM) Command and Control Enhancements (Supporting Precision Munition Analyses)

- Analytic Support to Unified Quest 2011

Research Highlights FY11

Among the program's major contributions and achievements in FY11 were the following:

- A G-8 sponsored study analyzed whether the Army can gain greater capability at lower cost by restructuring the overall force. The study developed and assessed structural options regarding the types and numbers of Army forces, given changes in the national security strategy, alternative force management policies, and the relative costs of active and reserve component units under varying deployment assumptions. The options included changes in the distribution of the types of units among the regular Army, the Army Reserve, and the Army National Guard, and the type, number, and size of units in the three organizations.

- A G-3/5/7 sponsored study contributed importantly to the understanding of security force assistance (SFA), a central pillar of counterinsurgency. Researchers conducted extensive fieldwork in Afghanistan and evaluated SFA efforts there over time. The team also analyzed U.S. and international approaches to building the Afghan force from 2001 to 2009, identified implications for the U.S. Army, and recommended how to improve SFA capability and execution. In addition, the team analyzed Soviet efforts to improve and facilitate the training and development of Afghan security forces, specifically, the Afghan military, police, and intelligence services. The study draws lessons for ongoing security force assistance in Afghanistan.

- A related study of the cost and efficacy of a Colombian program using local security forces to protect populations in approximately half of the country's municipalities assessed whether it reduced murder rates, increased electoral turnout, and improved intelligence gathering. The use of local security forces in Colombia may carry lessons for their use in Afghanistan.

- A G-8 sponsored study tested a key assumption of DoD planning, namely, that the timing of deployments and their distribution over time are more or less random. Using a dataset that includes U.S. Army contingency and peacekeeping deployments of at least company size that occurred between 1949 and 2010, Arroyo analyzed whether military deployments over this period occurred in clusters driven by temporal dependence. The results may contribute to more accurate projections of force requirements and more responsive tools for force shaping.

- In 2008, U.S. combined-arms operations in the Battle of Sadr City stopped Shiite extremists from firing short-range rockets and mortars into the International Zone and set conditions whereby stability and Iraqi government control could be extended to the whole of Baghdad. An Arroyo study analyzed the battle to develop insights and lessons learned that may improve understanding of urban operations and what future capabilities the Army will need. (See summary on page 40.)

- A G-8 sponsored study evaluated the effectiveness and robustness of changes in the global posture and forward basing of Army forces in the light of ongoing and potential changes in the national security environment. The study took into account political reliability and accessibility of bases as well as the utility of bases for a full range of potential missions.

- Another study examined historical operations to prop up friendly regimes "on the cheap"—e.g., with force ratios of 2 (or less) troops per 1,000 citizens versus the doctrinal 20 troops per 1,000 citizens. The project analyzed whether such "minimalist" stabilization operations were more or less likely to lead to favorable outcomes and, if so, under what circumstances. (See summary on page 36.)

Selected 2011 Publications

Building Afghanistan's Security Forces in Wartime: The Soviet Experience
Olga Oliker, MG-1078-A
www.rand.org/t/MG1078
Security force assistance is central to the counterinsurgency campaign of U.S. and coalition forces in Afghanistan. The outcome will hinge on the effectiveness of the assistance provided to the Afghan National Army, Afghan National Police, and other security forces. This monograph provides an overview of Soviet efforts to improve and facilitate the training and development of Afghan security forces.
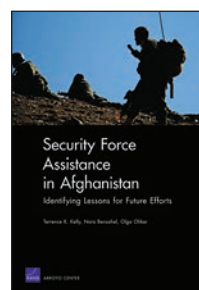
Security Force Assistance in Afghanistan: Identifying Lessons for Future Efforts
Terrence K. Kelly, Nora Bensahel, and Olga Oliker, MG-1066-A
www.rand.org/t/MG1066
Security force assistance (SFA) is a central pillar of the counterinsurgency campaign being waged by U.S. and coalition forces in Afghanistan. This monograph analyzes SFA efforts in Afghanistan over time, documents U.S. and international approaches to building the Afghan force from 2001 to 2009, and provides observations and recommendations that emerged from extensive fieldwork in Afghanistan in 2009 and their implications for the U.S. Army.

Hard Fighting: Israel in Lebanon and Gaza
David E. Johnson, MG-1085-A/AF
www.rand.org/t/MG1085
Like Israel in 2006, the United States today is likely ill prepared for hybrid warfare. To identify lessons that the U.S. military might learn from the Israeli experience in Lebanon, the author examines the state of the Israeli military before the Second Lebanon War, the lessons it learned during that conflict, the reforms it undertook to address its deficiencies, and how it fared during Operation Cast Lead three years later.

Heavy Armor in the Future Security Environment
David E. Johnson, OP-334-A
www.rand.org/t/OP334
The U.S. Army is under pressure to demonstrate a valid need for heavy brigade combat teams in the future security environment—an environment in which many believe that such units will be largely irrelevant. Through an examination of adversary capabilities in recent conflicts, the author explores whether heavy armored forces can be justified as a prominent component of the future U.S. Army.

The 2008 Battle of Sadr City
David E. Johnson, M. Wade Markel, and Brian Shannon, OP-335-A
www.rand.org/t/OP335
Using primary sources and interviews with those involved in the fighting and its aftermath, the authors describe the 2008 Battle of Sadr City, analyze its outcome, and derive implications for the conduct of land operations. Their analysis identifies factors critical to the coalition victory over Jaish al-Mahdi and describes a new model for dealing with insurgent control of urban areas. (See summary on page 40.)
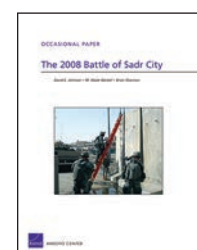
Manpower and Training Program

*Michael Hansen
directs the Manpower and Training Program.*

Mission and Research Streams

THE MANPOWER AND TRAINING PROGRAM, directed by Dr. Michael Hansen, focuses on policies that help the U.S. Army attract and retain the right people and train and manage them in a way that maximizes their capabilities. This includes active-duty personnel, members of the Army Reserve and Army National Guard, civilians, and contractors.

The program sustains research streams in four policy domains:
- Recruiting and retention
- Force management
- Leader development and training
- Soldier and family support

Within these streams, the Manpower and Training Program provides expertise and analysis developed over many years of focused and sustained research, as well as short-term, quick-response support on critical issues.

The program's FY11 research agenda within each of the four streams is illustrated to the right.

Sponsors of Manpower and Training Research

Each study in the Manpower and Training Program is sponsored by a senior Army leader; see the table below for the Army military and civilian leadership that sponsored one or more studies in the program in FY11. A study may be jointly sponsored by two or more leaders.

The Deputy Chief of Staff, G-1, U.S. Army, the Assistant Secretary of the Army (Manpower and Reserve Affairs), and the U.S. Army Training and Doctrine Command are the most frequent sponsors of studies in the Manpower and Training Program.

Sponsors of FY11 Studies in Manpower and Training

- Commanding General, U.S. Army Accessions Command
- Deputy Chief of Staff, G-8, U.S. Army
- Deputy Director, U.S. Army National Guard
- Commanding General, U.S. Army Cadet Command
- Deputy Chief of Staff, G-1, Director, Military Personnel Management, U.S. Army
- Deputy Commanding General, Combined Arms Center–Training, U.S. Army
- Deputy Commandant, Command and General Staff College, U.S. Army
- Director of Training, Deputy Chief of Staff, G-37, Training Directorate, U.S. Army
- Director, Installation Services, Assistant Chief of Staff for Installation Management, U.S. Army
- Deputy Assistant Secretary of the Army for Military Personnel
- Deputy Assistant Secretary of the Army for Civilian Personnel and Quality of Life
- Deputy Chief of Staff, G-1, Director, Plans and Resources, U.S. Army

Research Agenda FY11
Selected Projects

Recruiting and Retention

- Optimizing Production and Diversity of Army ROTC

- Lifecycle Analysis of Behavioral Health Professionals in the Army

- Interactions Between Accessions Programs and Prevailing Conditions

- Army Medical Corps and Dental Corps Recruiting Incentive Analysis

Force Management

- Manpower Support for Future Requirements

- Army Deployments to Operation Enduring Freedom and New Dawn

Leader Development and Training

- Assessing Effectiveness of the Intermediate Level Education Program

- Adapting Live Training Strategies to Better Support Full-Spectrum Operations and Persistent Conflict and to Leverage Advancing Technologies

- Training Strategies for Army National Guard Units

- Monitoring Skill Trends

- Army Military Education Level 1/Senior Service College Requirements Study

Soldier and Family Support

- Strategically Aligned Family Research

Research Highlights FY11

The Manpower and Training Program quantitatively analyzes alternative policies and resource mixes to improve effectiveness and efficiency and to develop useful approaches to key personnel issues. It develops and analyzes strategies for recruiting, training, and retaining quality soldiers, for structuring the future Army, and for recruiting and developing its leaders. The program also assesses collective and individual training approaches for the active and reserve components, and it evaluates alternative rotation, deployment, and assignment policies in support of the Army's missions.

Among the program's major contributions and achievements in FY11 were the following:

- Research on how soldiers' deployments affect children's academic performance and behavioral health contributed to several changes in Army policy. These changes included implementation of an Internet-based tutorial program for children; expanded efforts to educate school staff members about military challenges; working with schools that train behavioral health specialists to expand their curricula; and creation of a pilot program to develop Child and Family Assistance Centers. (See summary on page 34.)

- Analytic support provided to the Deputy Chief of Staff, G-1, Director, Plans and Resources examined ways to achieve reductions in active-duty endstrength. The study evaluated different force-shaping tools in light of the uncertainty surrounding the size and timing of reductions in endstrength as well as the near-term future of the U.S. economy.

- Analyses of the effect of military enlistment on earnings and education concluded that military service increases earnings relative to those of comparable civilians, particularly during the period of an enlistee's service. There also is a positive, long-term effect on the likelihood of obtaining a two-year college degree.

- U.S. Army Cadet Command received the program's support in developing policies that will help meet its near- and longer-term production and diversity goals, including those related to strategic posturing. Results from this analysis were incorporated into plans and mission allocations for some detachments.

- A study of the deployment cycle support (DCS) process looked at problems faced by soldiers and their families as well as Army civilians before, during, and after deployment. It evaluated how effectively the DCS delivery system addressed these problems and developed a method for monitoring service utilization, quality, and effectiveness in order to strengthen the support that DCS provides.

- When studying options to improve recruiter productivity, researchers examined increasing the number of recruiters; recruiter characteristics associated with higher productivity; assignment of recruiters to stations; and how recruiter performance should be evaluated. It provided recommendations to strengthen future recruiting performance.

- A study of the Army's program development efforts in Intermediate Level Education (ILE) compared levels of learning in the ILE Common Core among Resident, Total Army School System, and Advanced Distributed Learning delivery venues. The research team made recommendations on how to capture post-course attitudes and reactions, identified methods and measures to assess effectiveness, and provided guidelines for infrastructure improvements that would support more efficient and effective evaluation.

- The Assistant Chief of Staff for Installation Management received an assessment of the Quality of Life programs that soldiers and families need. The study identified how research is currently used, where gaps in knowledge exist, and how the Army should think strategically about using research, including its investment in new research, in order to identify its most effective programs and services and make the best use of available resources.

Selected 2011 Publications

Effects of Soldiers' Deployment on Children's Academic Performance and Behavioral Health

Amy Richardson, Anita Chandra, Laurie T. Martin, Claude Messan Setodji, Bryan W. Hallmark, Nancy F. Campbell, Stacy Hawkins, and Patrick Grady, MG-1095-A

www.rand.org/t/MG1095

RAND Arroyo Center was asked by the Army to examine the effects of parental deployments on children's academic performance as well as their emotional and behavioral well-being in the school setting. The researchers found that children whose parents have deployed 19 months or more since 2001 have modestly lower, statistically different achievement scores compared with those who have experienced less or no parental deployment. (See summary on page 34.)
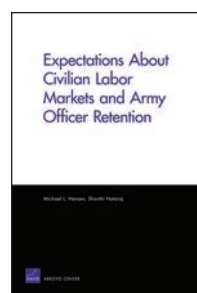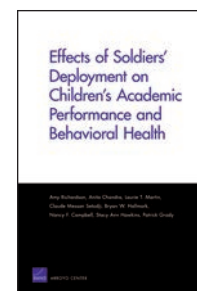
Expectations About Civilian Labor Markets and Army Officer Retention

Michael L. Hansen and Shanthi Nataraj, MG-1123-A

www.rand.org/t/MG1123

This monograph develops a comprehensive picture of the socioeconomic environment officers will encounter if they leave active-duty service and analyzes the potential impact of these factors on Army retention and how major differences between military and civilian employment can be effectively communicated to officers making stay/leave decisions. (See summary on page 42.)

Developing U.S. Army Officers' Capabilities for Joint, Interagency, Intergovernmental, and Multinational Environments

M. Wade Markel, Henry A. Leonard, Charlotte Lynch, Christina Panis, Peter Schirmer, and Carra S. Sims, MG-990-A

www.rand.org/t/MG990

New Tools and Metrics for Evaluating Army Distributed Learning

Susan G. Straus, Michael G. Shanley, Douglas Yeung, Jeff Rothenberg, Elizabeth D. Steiner, and Kristin J. Leuschner, MG-1072-A

www.rand.org/t/MG1072

Improving Soldier and Unit Effectiveness with the Stryker Brigade Combat Team Warfighters' Forum

Bryan W. Hallmark and S. Jamie Gayton, TR-919-A

www.rand.org/t/TR919

The Effect of the Assessment of Recruit Motivation and Strength (ARMS) Program on Army Accessions and Attrition

David S. Loughran and Bruce R. Orvis, TR-975-A

www.rand.org/t/TR975

The Effect of Military Enlistment on Earnings and Education

David S. Loughran, Paco Martorell, Trey Miller, and Jacob Alex Klerman, TR-995-A

www.rand.org/t/TR995

Force Development and Technology Program

*Christopher G. Pernin
directs the Force Development and Technology Program.*

Mission and Research Streams

THE FORCE DEVELOPMENT AND TECHNOLOGY PROGRAM, directed by Dr. Christopher Pernin, explores how technological advances and new operational concepts can improve the Army's effectiveness in current and future conflicts. Its research agenda focuses on helping the Army maintain its technological edge against adaptable adversaries. This is accomplished by performing assessments of a technology's feasibility, performance, cost, and risk.

The program sustains research streams in four policy domains:

- Operations and technologies
- Intelligence, surveillance, and reconnaissance (ISR) and force protection
- Cyber and network capabilities
- Acquisition and modernization

The program's FY11 research agenda within each of these streams is illustrated to the right.

Sponsors of Force Development and Technology Studies

Each study in the Force Development and Technology Program is sponsored by a senior Army leader. The table below lists the Army's military and civilian leadership that sponsored one or more studies in the program in FY11. Occasionally a study is jointly sponsored by two or more leaders.

The Army G-3/5/7 and the Assistant Secretary of the Army for Acquisition, Logistics and Technology are the most frequent sponsors of studies in the Force Development and Technology Program. Other frequent sponsors include U.S. Army Training and Doctrine Command, Army G-6, and Army G-8.

Sponsors of FY11 Studies in Force Development and Technology

- U.S. Army Training and Doctrine Command
- Deputy Chief of Staff, G-3/5/7, U.S. Army
- Chief Information Officer, G-6, U.S. Army
- Deputy Chief of Staff, G-8, U.S. Army
- Combined Arms Center

- Assistant Secretary of the Army for Acquisition, Logistics and Technology
- Assistant Secretary of the Army for Installations and Environment
- Assistant Chief of Staff for Installation Management/Installation Management Command
- Night Vision and Electronic Sensors Directorate
- Deputy Assistant Secretary of the Army for Acquisition, Logistics and Technology
- Deputy Assistant Secretary of the Army for Cost and Economic Analysis

Research Agenda FY11
Selected Projects

Understanding Army Operations and Technologies in the 21st Century

- Materiel Strategies to Help Enable the Soldier as a Decisive Weapon

- Staff Organization to Support Mission Command and Decentralized Operations

- Advanced Technology Sensors and Data Exploitation

- Assessing the Applicability of New Energy Technologies for Meeting Future Army Installation Needs

Assessing ISR and Force Protection for Irregular Warfare

- Assessment of Advanced Science and Technology (S&T) Capabilities to Support Irregular Warfare

- Understanding the Resource and Force Structure Implications of Force Protection in Irregular Warfare

- Analytic Support to the Army G-8, Post-QDR Analysis

Understanding and Improving Army Cyber and Network Capabilities

- Army Management and Enterprise Requirements for the Cyber/Electromagnetic Contest

- The Human Factor: Net Management Capabilities for the Army Tactical Network

Improving Army Acquisition and Modernization

- An After Action Analysis of the Future Combat System

- Army Cost-Effective Analyses for Entry into or Continuing in Various Phases of the Defense Acquisition Management System

- Planning a Post–Operation Enduring Freedom Army Equipping Strategy

Research Highlights FY11

The Force Development and Technology Program seeks to provide unbiased, independent assessments of new weapon systems and operational concepts that emphasize jointness. It also analyzes new technologies to support future Army analytical needs and refines strategies for developing new technologies and acquiring new systems. Both Arroyo and other RAND research units develop and maintain analytical combat models and simulations that support these analytic competencies.

In FY11, the program featured work on exploiting information technology for command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR); continued development of modeling and simulation tools for examining modern conflicts; seeking efficiencies in the materiel acquisition process; and examining emerging trends in warfighting, such as IED (improvised explosive device) use, cyber-operations, and the use of unmanned systems.

Among the program's major contributions and achievements in FY11 were the following:

- A TRADOC-sponsored study offers an updated framework for understanding how best to apply cyberpower in support of ground combat operations. The worldwide trend toward a wireless medium demands doctrinal changes. This study analyzes the boundaries between information operations and electronic warfare today and examines the implications for emerging doctrine on cyber operations.

- Arroyo analyzed the capabilities of the Joint Tactical Radio System (JTRS) and legacy radios, including off-the-shelf systems, being used in theater. Using the RAND-developed Network Effectiveness Analysis Tool, the study team evaluated the performance of Infantry Brigade Combat Team (IBCT) data network designs based on these systems. The study identified changes to the radio mix, subnet configurations, and spectrum allocations for the IBCT data network that should affordably improve network performance.

- Over the last decade, urgent operational needs for command and control (C2) systems have been satisfied by a number of Joint and Army rapid acquisition processes. These non-program-of-record acquisitions satisfied immediate needs, but they also pose both short- and long-term management challenges. An Arroyo study assessed past and current experience with the rapid acquisition of C2 systems through nontraditional means, providing detailed case studies of three systems.

- An Arroyo study analyzed an equipping strategy that would align the assignment of some major end items with the Army Force Generation (ARFORGEN) cycle in order to reduce the total quantity required and procured by the Army. The strategy could provide considerable opportunity for near- and far-term cost savings while preserving the Army's overall capability to provide a ground combat capability through protracted deployments and "surge" situations. The study described how a rotational equipping strategy would work and estimated the potential magnitude of savings. (See summary on page 48.)

- Arroyo hosted the annual G-6 Studies Day, where Army leaders, key staff members, and research partners heard briefings of recently completed, ongoing, and planned studies sponsored and co-sponsored by the G-6, including two Arroyo studies.

Selected 2011 Publications

Toward Affordable Systems II: Portfolio Management for Army Science and Technology Programs Under Uncertainties

Brian G. Chow, Richard Silberglitt, Scott Hiromoto, Caroline Reilly, and Christina Panis, MG-979-A
www.rand.org/t/MG979

This companion to *Toward Affordable Systems: Portfolio Analysis and Management for Army Science and Technology Programs* (Brian G. Chow, Richard Silberglitt, and Scott Hiromoto, MG-761-A, 2009) describes the continued development and demonstration of a method and model to incorporate lifecycle cost into the portfolio analysis and management process for U.S. Army Science and Technology programs.
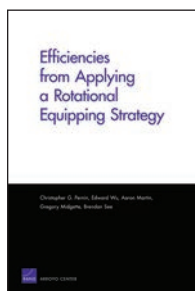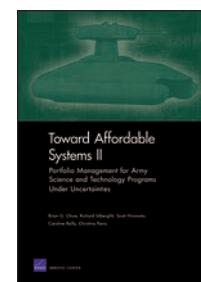
## Efficiencies from Applying a Rotational Equipping Strategy

Christopher G. Pernin, Edward Wu, Aaron L. Martin, Gregory Midgette, and Brendan See, MG-1092-A
www.rand.org/t/MG1092

To meet the demands of the past decade of conflict in Iraq and Afghanistan, the Army has adopted a rotational strategy based on the Army Force Generation (ARFORGEN) model, but equipping policies have not yet been adapted to the model. This report analyzes how the Army might reduce equipment in early phases of the ARFORGEN cycle, how changes might be applied across Army units and equipment, and how changes might affect near- and far-term budgets. (See summary on page 48.)

Perspectives on the Battle of Wanat: Challenges Facing Small Unit Operations in Afghanistan

Randall Steeb, John Matsumura, Thomas J. Herbert, John Gordon IV, and William W. Horn, OP-329/1-A
www.rand.org/t/OP329z1

Using the Battle of Wanat as a case study, the authors explore and evaluate a range of alternative technological and corresponding tactical improvements to help small unit operations in Afghanistan, particularly when the mission is to establish and protect combat outposts. The authors develop a tactical-level understanding of the circumstances and risks that a small unit faced as it transitioned from a vehicle patrol base to a combat outpost.
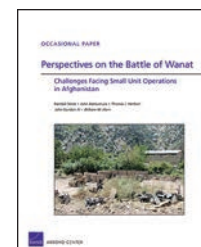
Where Might the U.S. Army Budget Go, and How Might It Get There?

Carter C. Price, Aaron L. Martin, Edward Wu, and Christopher G. Pernin, OP-331-A
www.rand.org/t/OP331

Army Tactical Wheeled Vehicles: Current Fleet Profiles and Potential Strategy Implications

Carolyn Wong, Louis R. Moore, Elvira N. Loredo, Aimee Bower, Brian Pascuzzi, and Keenan D. Yoho, TR-890-A
www.rand.org/t/TR890

Military Logistics Program

*Kenneth J. Girardini
directs the Military Logistics Program.*

Mission and Research Streams

THE MILITARY LOGISTICS PROGRAM, directed by Dr. Kenneth J. Girardini, conducts analyses to help the Army improve support to operational forces, enhance the effectiveness and efficiency of its business processes, and optimize the industrial base and support infrastructure.

The Military Logistics Program sustains research streams in four policy domains:

- Supply chain management
- Fleet management and modernization
- Logistics force development
- Infrastructure management

In all these domains, Arroyo draws on extensive research capital to provide timely short-term analytical assistance to senior decisionmakers on urgent logistics issues.

The program's FY11 research agenda within these four streams is illustrated to the right.

Sponsors of Military Logistics Research

Each study in the Military Logistics Program is sponsored by a senior Army logistician. The table below lists the military and civilian leadership that sponsored one or more studies in the program in FY11. Occasionally a study is jointly sponsored by two or more leaders.

The Army G-4, the Army Materiel Command, and the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA[ALT]) are the most frequent sponsors of studies in the Military Logistics Program. Other frequent sponsors include the U.S. Army Training and Doctrine Command, the U.S. Army Special Operations Command, the Army Medical Research and Materiel Command, and the Deputy Assistant Chief of Staff for Installation Management.

Sponsors of FY11 Studies in Military Logistics

- Deputy Chief of Staff, G-4, U.S. Army
- Commanding General, U.S. Army Special Operations Command
- Director, Futures Center (ARCIC), U.S. Army Training and Doctrine Command
- Commanding General, U.S. Army Installation Management Command
- Commanding General, U.S. Army Medical Research and Materiel Command and Fort Detrick
- Director, Force Development, Headquarters Department of the Army, G-8
- Defense Logistics Agency, J3

- G-4, U.S. Army Materiel Command
- Assistant Secretary of the Army for Installations, Energy, and the Environment
- Assistant Secretary of the Army for Acquisition, Logistics and Technology
- Director of Contracting, U.S. Army Materiel Command
- Acting Deputy Assistant Secretary of the Army for Procurement
- Deputy to the Commander, Surface Deployment and Distribution Command, Headquarters Army Materiel Command

Research Agenda FY11
Selected Projects

Supply Chain Management

- Improving Central Issue Facility Organizational Clothing and Individual Equipment (OCIE) Management
- Improving Inventory Management of OCIE at Sierra Army Depot
- Addressing Systemic Issues in Global Distribution Support
- Managing Supplier Relationships Through the Drawdown
- Understanding the Impact of Budget and Procurement Processes on Army Materiel Command's Inventory Turn Rate
- Identifying and Managing Part Quality Problems
- Improving Army War Reserve (WRSI) Processes
- Alternative Support Strategies for Tire Assembly Repair Locations in Southwest Asia and Army-Wide
- Identifying the Causes of Serviceable Retrograde
- Support for and Expanding the Capabilities of the Army's Expert ASL Team
- MEDLOG Warehouse and Information Technology Efficiency Assessment

Fleet Management and Modernization

- Support Implications of New Equipping Concepts
- Improving Army Equipment Transparency

Logistics Force Development

- Requirements for Contract Logistics Support
- Metrics for Army Operational Contract Support
- Army Special Operations Forces Unconventional Warfare Logistics Requirements
- Procurement Lead Time and Workload Modeling

Infrastructure Management

- Assessing the Applicability of New Energy Technologies for Meeting Future Army Installation Needs
- Funding of Ammunition Ports

Research Highlights FY11

At the strategic level, research on military logistics helps the Army to develop a compelling vision of future support capabilities as well as an effective and efficient strategy for executing the vision. In accordance with the vision, Arroyo develops and evaluates alternatives in major logistics policy areas. Arroyo also identifies and evaluates improvements to logistics processes that will enhance performance and deployability or will reduce costs and achieve efficiencies while maintaining or even improving effectiveness, and provides analytic support to Army implementation efforts.

Among the program's major contributions and achievements in FY11 were the following:

- A project to help the Army better manage organizational clothing and individual equipment (OCIE), sponsored by the G-4, implemented new inventory management techniques at most CONUS central issue facilities (CIFs). The pilot of these improved techniques was rapidly rolled out across the Army, and they are now being integrated into the Army's systems. The success of this initiative has allowed the Army to reduce OCIE budgets by $100 million. (See summary on page 44.)

- Arroyo researchers working on a G-4 sponsored project worked with several installations to implement improvements to distribution suggested by empirical analyses and process walks. As a result, units were added to existing scheduled truck deliveries, installations were identified as candidates to add to existing scheduled truck routes, and units streamlined reviews.

- Over the past ten years, the Army's costs for contractor logistics support (CLS) of 26 systems have increased by approximately $400 million. A Military Logistics Program study analyzed the reasons for these cost increases, focusing on three CLS-supported weapon systems: the Shadow unmanned aerial system, Sentinel radars, and Javelin.

- A joint RAND-Army Materiel Systems Analysis Activity (AMSAA) study, sponsored by AMC-G4, on inventory turns is helping the Army with an improved process for identifying dormant and excess stocks to reduce storage costs.

- A G-4 sponsored study helped to draw down tactical inventories in Iraq efficiently while maintaining supply performance for critical parts, working closely with the Army's Expert authorized stockage list (ASL) review team as well as AMC-G4 and theater personnel. The same project also developed algorithms and provided the Army monthly runs of what ASL inventory would likely be reutilized locally in southwest Asia and what should be moved out of theater. This was expanded to Army installations in CONUS and other theaters.

- A G-4 sponsored project has developed new algorithms to leverage empirical demand data to improve Army war reserve inventories.

- A study sponsored by AMC-G4 identified analytical techniques to identify potential part-quality problems and prioritize them based on increased supply chain costs and readiness impacts.

- A study sponsored by the Assistant Chief of Staff for Installation Management (ASCIM) on how the Army could improve collaboration with utility companies to reduce energy consumption on installations was presented at the Federal Utility Partnership Working Group Meeting in Philadelphia. The study identified options for improved collaboration to achieve energy goals as well as ways to overcome the barriers to achieving them. (See summary on page 38.)

- Late in 2011, a quick-turnaround study for PM Abrams examined whether it would be more costly for the Army to continue production of M1A2 tanks than to shut down production and restart. The study considered uncertainties such as the size of future force structure reductions and the timing of the commencement of M1A2 modernization.

Selected 2011 Publications

Using Field Data to Improve Authorized Stockage List Push Packages

Marygail K. Brauner, Arthur Lackey, and John Halliday, DB-619-A

www.rand.org/t/DB619

Readiness problems associated with newly fielded systems are relevant to both combat effectiveness and public perception. When new equipment comes into the Army, it is often fielded on a unit-by-unit basis, so the "initial" fielding can take many years. This report demonstrates the feasibility of using demands from earlier fieldings to improve push packages as equipment is fielded to successive units.
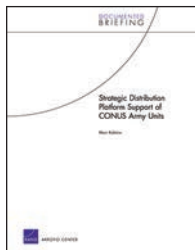
Strategic Distribution Platform Support of CONUS Army Units

Marc Robbins, DB-632-A

www.rand.org/t/DB632

The Army desires a distribution system for home station units that provides timely and low-cost delivery of needed supplies. A critical part of this system is the scheduled truck service provided by the Strategic Distribution Platforms. Although this system is relatively strong, researchers explored ways to improve it by adding new units and posts to the truck network and taking other steps to reduce "leakage" from the truck network.

Making the Connection: Beneficial Collaboration Between Army Installations and Energy Utility Companies

Beth E. Lachman, Kimberly Curry Hall, Aimee E. Curtright, and Kimberly Colloton, MG-1126-A

www.rand.org/t/MG1126

This study explores how the Army could improve installation collaboration with utility companies to reduce energy consumption and help meet other Army energy goals. It examines how installations collaborate with utilities, the barriers to such collaboration, and the study team's recommendations about how best to overcome the barriers to improve installation collaboration with utility companies for mutual benefit. (See summary on page 38.)
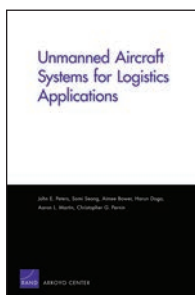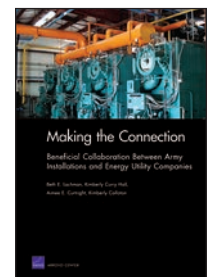
Unmanned Aircraft Systems for Logistics Applications

John E. Peters, Somi Seong, Aimee Bower, Harun Dogo, Aaron L. Martin, and Christopher G. Pernin, MG-978-A

www.rand.org/t/MG978

RAND Arroyo Center evaluated potential logistics applications for unmanned aircraft systems (UAS) to determine whether they are technically feasible, operationally feasible, and more cost-effective than other options. The study identified six factors that could be used to compare UAS and non-UAS based solutions to logistics tasks. The study uncovered significant potential for logistics applications of these systems in the near- and long-term future.

Military Health Program

Terri Tanielian
directs the Military Health Program.

Mission and Research Streams

THE MILITARY HEALTH PROGRAM, directed by Ms. Terri Tanielian, conducts analyses designed to ensure that the medical readiness and health benefit missions of the Army are carried out effectively and efficiently. In collaboration with RAND Health, a separate division of the RAND Corporation, research in this program is conducted through the Center for Military Health Policy Research, which has experience in developing and evaluating alternative policies to reduce the costs of health care, achieve efficiencies, enhance quality of care, and improve the productivity of health providers, as well as assessing the medical readiness of soldiers and programs.

To accomplish its mission, the program seeks to sustain research streams in six policy domains:

- Health promotion and health care provision
- Deployment-related health issues
- Quality of health care
- Reducing costs and improving productivity
- Medical readiness
- Future demands on medical personnel

Maintaining expertise in these domains will allow the program to provide timely short-term assistance on military health issues of importance to the Army.

The program's FY11 research agenda consisted of the projects displayed to the right.

Sponsors of Military Health Research

Each study in the Military Health Program is sponsored by one or more senior Army leaders. The Army Surgeon General is the most frequent sponsor of studies in the Military Health Program. Other sponsors include the U.S. Army Reserve and U.S. Army Medical Research and Materiel Command (USAMRMC).

Research Highlights FY11

Military Health Program projects include studies of policies and programs for enhancing health promotion and providing care on the battlefield, in garrison, and in Army medical facilities. Arroyo has the capability to estimate the health-related effects of deployment on soldiers and their families and assess programs to alleviate these effects; examine the appropriateness, cost, and quality of health care; and provide analytical support to efforts to improve the effectiveness and efficiency of health care. Additional capabilities include evaluating the implications of advances in medical technology, and contributing toward analyses of the requirements for medical personnel in the full spectrum of future demands, including combat support, nation building, and humanitarian or disaster response operations.

Among the program's major contributions and achievements in FY11 were the following:

- In early 2011, the program hosted a meeting on behalf of USAMRMC to obtain information from a broad community (industry, academia, and other federal agencies) on the availability of simulation technologies, blast test devices, sensors, and computational models that can realistically

predict occupant injuries in Under-Body Blast (UBB) live-fire tests of ground combat vehicles. The insights gathered at the conference will inform the development of an acquisition program for a UBB anthropomorphic test dummy.

- Using administrative data maintained by the Army, the program has been measuring the effects of deployment cycle experiences on mental health outcomes of Army soldiers. Researchers were able to link data on deployment histories and other personnel files with data from both the post-deployment health assessment and the post-deployment health reassessment to examine the relationship between deployment cycle experiences (deployment timing, permanent change of station moves, unit turbulence, experience of noncommissioned officers, etc.) on the outcomes observed in the post-deployment health surveillance screenings.

- The program conducted a survey of medical providers to assess potential changes to the Army Medical Department's Professional Filler System. The survey examined provider perceptions of PROFIS and gathered feedback on potential improvement strategies. Researchers are using the results of the survey as well as other administrative analyses and key stakeholder interviews to provide lessons learned and recommendations for improvement.

Research Agenda FY11
Selected Projects

Health Promotion and Health Care Provision

- Enhancing the Effectiveness of the U.S. Army's Participation in Medical Diplomacy: Implications from a Case in Trinidad

Deployment-Related Health Issues

- ARFORGEN and the Ability of Army Medical Treatment Facilities to Meet Beneficiary Health Care Needs: Phases 1 and 2

- Addressing the Psychological Health and Behavioral Effects of ARFORGEN and OPTEMPO: Phases 1 and 2

- New Capabilities for Assessing Injuries Caused by Under-Body Blast

Future Demands on Medical Personnel

- The Future of the Army Medical Department's Professional Filler System

Quick-Response Studies

RAND Arroyo Center reserves a portion of its research agenda for fast-turn studies on important issues that emerge during the course of the fiscal year. In FY11, Arroyo completed five such quick-response studies for the Army.

Analysis of Alternative Rotation Rates for Regular Army Forces. To meet the demands of two simultaneous wars, the Army has rotated units in and out of Iraq and Afghanistan at a fast rate for several years. As a result, soldiers and their families have experienced significant stress. As demand declines for forces in these conflicts, the Army may be able to change its rotation policy by shortening tour lengths, increasing time between tours, or some combination of these. This study provided the Army G-8 with a quick-response comparative analysis of alternative rotation rates, including tour length, for active Army forces—specifically 1:2 (12:24), 1:3 (9:27), and 1:5 (6:30).

Assessing Processes for Developing and Procuring Body Armor. The body armor that U.S. forces wear in Afghanistan is effective against ballistic threats but is heavy in weight. It represents a large portion of the load that soldiers and marines carry on patrol and into combat. In Section 125 of the National Defense Authorization Act for Fiscal Year 2011, Congress requested that a federally funded research and development center conduct a study of lightening body armor. The Deputy Assistant Secretary of the Army for Research and Technology selected Arroyo to do the study. It looked at the processes used to specify the requirements for lighter-weight body armor systems and determined ways to more effectively address the research, development, and procurement requirements that aim at reducing the weight of body armor.

Army Civilian Workforce Transformation. The objective of this study, requested by the Army G-1, was to assist the Army in evaluating and implementing a comprehensive set of Civilian Workforce Transformation (CWT) initiatives that support the development and maintenance of a flexible and adaptive civilian workforce. Civilian management is critical to transformation because Army civilians represent more than half of the generating force. Previously, civilian career management has been decentralized and reactive. For instance, only one of the 23 approved Career Programs participates in the HQDA resource and decisionmaking process.

Clarification of the Level of Army Overhead. This study was requested by the Assistant Secretary of the Army (Financial Management and Comptroller). Its objective was to clarify what Army resources cannot be easily linked to Army products delivered to outside users, resources that best commercial practice would consider overhead.

Conflict with China: Prospects, Consequences, and Strategies for Deterrence. Sponsored by the Deputy Chief of Staff, G-8, U.S. Army, this study examined sources of conflict most likely to occasion a China-U.S. military clash over the next thirty years, identified the operational implications of each, and determined the resultant requirements for defense and deterrence. (See summary on page 46.)

Selected 2011 Publication

Conflict with China: Prospects, Consequences, and Strategies for Deterrence
James Dobbins, David C. Gompert, David A. Shlapak, and Andrew Scobell, OP-344-A
www.rand.org/t/OP344

Summaries of Selected FY 2011 Studies

- How Do Soldiers' Deployments Affect Children's Academic Performance and Behavioral Health?

- The Value and Limitations of Minimalist Stabilization Efforts

- Collaborating with Energy Companies

- Urban Warfare: The 2008 Battle for Sadr City

- Identifying Civilian Labor Market Realities for Army Officers Making Stay/Leave Decisions

- Helping The Army Better Manage Its Inventory of Organizational Clothing and Individual Equipment (OCIE)

- What's the Potential for Conflict with China, and How Can It Be Avoided?

- Achieving Efficiencies Through a Rotational Equipping Strategy

How Do Soldiers' Deployments Affect Children's Academic Performance and Behavioral Health?

KEY POINTS

- Children whose parents have deployed 19 months or more since 2001 have modestly lower (and statistically different) achievement scores compared with those who have experienced less or no parental deployment.

- Teachers and counselors identified a range of deployment-related issues that may affect children's academic success, including problems with homework completion, school attendance, and parental engagement.

- Options for improving support to children include providing additional resources to assist students with schoolwork, improving information flow to schools, and increasing the number of providers trained in child and adolescent behavioral health issues.
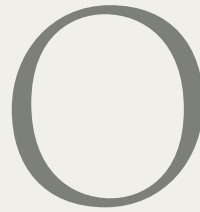
Ongoing deployments have placed stresses on Army children and families already challenged by frequent moves and parental absences. These stresses include social or behavioral problems among children at home and at school. With a better understanding of the issues that children face when a parent or guardian deploys, the Army can more effectively target services for military families and their children to address those needs.

The Army asked RAND Arroyo Center to assess the effects of soldiers' deployments on their children's academic performance and emotional and behavioral outcomes in the school setting, and to make recommendations to support programs to ensure that children's academic and emotional needs are met. Efforts are already underway in some areas.

What Academic Challenges Do Children Face When Parents Deploy?

To understand the relationship between deployment and academic achievement, researchers conducted statistical analyses of the correlation between parental deployment and student achievement test scores for public school students in North Carolina and Washington between 2002 and 2008. The analysis included school-age children of soldiers in the active force, Army Reserve, and Army National Guard. Researchers also conducted interviews with school staff concerning the challenges students face and options for support.

The study found the following:

Children whose parents have deployed for a total of 19 months or more since 2001 have modestly lower (and statistically different) achievement scores compared with those who have experienced less or no parental deployment. This finding holds across states and academic subjects; is consistent across the rank or component of the soldier, seniority of the soldier, gender of the deploying parent, and gender of the child, and it is stable over time. The relationship is stronger for elementary and middle school students, but not significant for high school students. These differences in academic performance suggest that, rather than developing resiliency, children appear to struggle more with more cumulative months of deployment.

The study found no other consistent, statistically significant differences in academic performance among children in the sample. In both states, the *number* of deployments is not associated with children's academic performance once the researchers accounted for cumulative months of deployment.

Teachers and counselors identified a range of deployment-related issues that may affect children's academic success. These include problems with homework completion, school attendance, and parental

engagement, as well as stress related to household responsibilities or resident parents' mental or emotional problems concerning their partner's deployment.

School staff had little consistent information to let them know which students are military and when students may be experiencing deployment. These difficulties were sometimes more pronounced for educators serving Reserve and National Guard families because these students tend to be a small minority in their schools.

What Psychological and Behavioral Health Challenges Do Families Face During Deployment?

Interviewees also identified barriers to behavioral health services for children of deployed soldiers.

School staff identified parental struggles as a challenge for youth. Staff believed that some parents appear to be struggling with deployments more than their children are. Staff also reported that for many children, resiliency appears to be decreasing. Some staff felt they did not often have adequate assistance in helping students and parents access psychological and behavioral health services. Military Family Life Consultants (MFLCs) may provide necessary student, family, and staff support in schools, but those interviewed felt that the monitoring and evaluation of this program could be improved.

Stakeholders felt that the number of available providers with training in child and adolescent services is low. Further, the availability and coverage of certain behavioral health services, as well as prevention, screening, and early intervention, are not adequate and vary geographically. Stakeholders also noted that some providers do not have good grounding in military culture.

> With a better understanding of the issues that children face when a parent or guardian deploys, the Army can more effectively target services for military families and children to address those needs.

Recommendations

Improving support is an ongoing process. Arroyo researchers identified several options the Army might consider to address the challenges faced by military children regarding parental deployment. Because most of these recommendations come with a financial cost, the Army should carefully analyze these costs before pursuing any changes.

Academic and School-Based Needs

- Provide additional resources to assist students with schoolwork and transportation to school activities, and develop procedures to help schools obtain Army Community Services support to engage unresponsive parents.
- Address challenges related to high mobility, e.g., by continuing to advocate for full implementation of the Interstate Compact on Educational Opportunity for Military Children, which addresses state variation in the transfer of records, course sequencing, and graduation requirements.
- Develop methods to inform schools about which children are military, when children's parents are deploying, and what support and services are available for military families.

Behavioral Health Needs

- Support efforts to increase the number of providers trained in child and adolescent behavioral health issues, and develop provider training on military culture and deployment impacts.
- Expand models to improve access for hard-to-reach populations, including telepsychiatry programs and social networks to support Reserve Component families.
- Consider strategies for improving prevention, screening, and early identification of behavioral health issues, particularly in schools and other community settings, and for improving family engagement in behavioral health services.
- Provide information to help school staff assist students and parents in accessing services.
- Improve evaluation of the MFLC program by integrating outcomes-based measurement. ■

The Value and Limitations of Minimalist Stabilization Efforts

KEY POINTS

- Minimalist stabilization missions do not improve the partner government's chances of victory; however, they do dramatically reduce the odds of defeat.

- Most commonly, minimalist stabilization missions result either in military stalemate or significant compromise with the insurgents, and such outcomes frequently lead to new conflict unless an international force is present to stabilize the post-conflict order.

- By comparison, large-scale interventions improve the chances of both attaining victory and avoiding defeat (although they have been few, so generalizations are tentative).

The prolonged military and political interventions undertaken by the United States in Iraq and Afghanistan have elicited much criticism. Some critics claim that these wars demonstrate the futility of military interventions generally. Others accept that interventions will sometimes be necessary, but argue that large "nation-building" missions are neither affordable nor effective, advocating instead for small-scale operations designed to tip the balance in favor of local U.S. allies.

To help the United States determine the proper scale of interventions, researchers at RAND Arroyo Center examined both the value and the limitations of such "minimalist stabilization" efforts. They assessed all civil wars or insurgencies of the past 40 years, comparing those that entailed large-scale nation building missions, minimalist stabilization operations, or no foreign intervention. The research team augmented this quantitative assessment with in-depth case studies.

Defining "Minimalist Stabilization"

The goal of a large-scale nation-building mission is to enforce peace and rebuild the political institutions and economy of a weak or failed state. Minimalist stabilization efforts are less ambitious, offering small-scale and less costly support to governments under threat. Operations are usually conducted through the existing local power structures, and they typically emphasize rapid development of and transfer of responsibility to the host nation's own security forces. There will be many criteria on which to judge "success" in such an effort, but this study focuses on one key dimension: did the mission help the supported government achieve military victory in its counterinsurgency campaign?

Minimalist Stabilization Efforts Typically Do Not Improve the Odds of Victory

Since 1970, there have been 22 minimalist stabilization missions on behalf of a government fighting an insurgency. In only three cases in the past four decades (Republic of Congo, 1997–98; Oman, 1971–75; Zaire, 1977–78) did minimalist efforts clearly tilt the balance toward military victory by the supported government. Overall, an examination of the outcomes of all minimalist stabilization missions suggests that these efforts do not significantly improve the supported government's chances of winning a civil war.
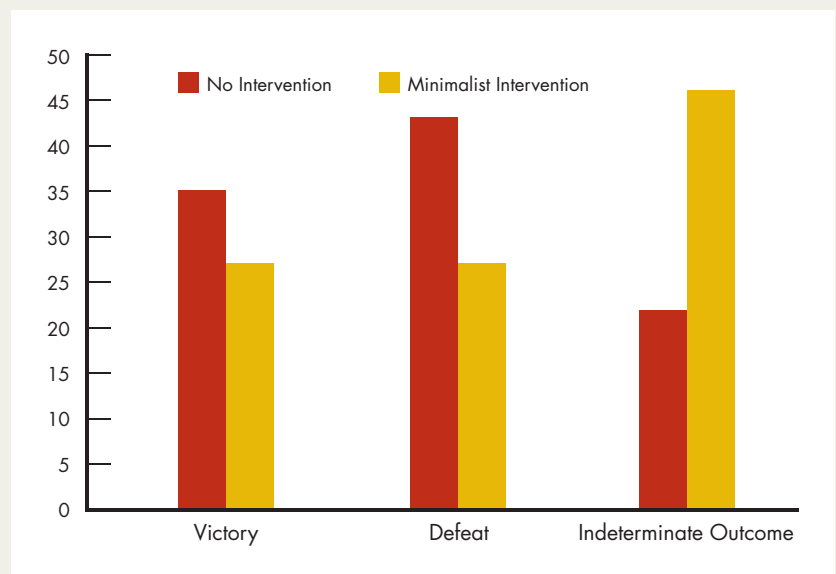
But Minimalist Stabilization Efforts Can Lessen the Odds of Defeat

The figure illustrates the extent to which minimalist stabilization efforts have benefited supported governments.

When minimalist stabilization is employed, the likelihood of a supported government's defeat falls dramatically. This improvement is not, however, mirrored by a corresponding increase in the probability of victory. Instead, the most probable result of minimalist stabilization is a mixed outcome—that is, either military stalemate or a negotiated settlement that concedes considerable political and security rights to the insurgents. These results suggest that minimalist stabilization often contributes to significant operational successes—the degrading of insurgent capabilities—but seldom to decisive outcomes.

Outcomes in Minimalist Interventions and No Interventions

Knowing the Limits of Minimalist Stabilization Efforts Can Improve Outcomes

The study finds that minimalist stabilization efforts usually do not alter the underlying structure of the conflict. They also typically do not help foster political reforms in the supported government, nor do they cut insurgents off from their resource bases. Minimalist stabilization missions may in fact make the situation worse. They may provide just enough resources to alleviate any pressure on the supported government to reform itself, and at the same time offer too little to enable or compel the state to undertake significant reforms. These dynamics suggest that the operational gains attributable to minimalist stabilization can be converted into decisive success only if the underlying political or international structure of the conflict can be altered.

Understanding the limits of what these efforts can achieve can improve the effectiveness of an intervention. First, minimalist stabilization appears most likely to yield victory when both the government and the insurgents are weak. Second, minimalist forces are usually adequate to conduct consensual peacekeeping missions. The odds of success might also be improved by combining minimalist operations with nonmilitary instruments; where feasible, the intervening power should work with key countries to deny the armed opposition the resources required for insurgency.

Policy Implications

Future U.S. minimalist stabilization efforts should reflect an understanding of both the possibilities and the limitations of minimalist stabilization. Most minimalist interventions lead to stalemate or negotiated settlements: outcomes that are historically precarious and frequently lead to renewed fighting. This suggests that the need for stabilization missions does not end with the end of conflict but endures well into the post-conflict period. Lengthy missions can place significant stress on U.S. armed forces, and the United States should seek to enlist other partners in such missions.

Minimalist stabilization operations yield a reasonable chance of modest success for a modest cost. In some circumstances they are perfectly appropriate and indeed should be the preferred tool to realize U.S. foreign policy goals. But they are not always appropriate The evidence in this study suggests that in the worst environments, only large-scale interventions can provide a sizable improvement in the odds of securing an acceptable outcome. ■

Minimalist stabilization operations yield a reasonable chance of modest success for a modest cost.

Collaborating with Energy Companies

KEY POINTS

- The Army spends over $1 billion per year on installation energy and wants to reduce that cost.

- Installations can collaborate with energy utilities to lower costs through such mechanisms as Utility Energy Service Contracts and Utility Service Contracts.

- Barriers limit such collaboration, including a lack of expertise at the installation and the energy utility, perceived project risk, and the time it takes to pay back an investment.

- The Army can help overcome barriers by educating installation staff, issuing supportive policies, and advertising successful collaborations.

A rmy installations consume lots of energy and would like to reduce that consumption and what it costs (over $1.2 billion in 2010). However, installations do not have many investment options to achieve such goals nor any consistent funding for efficiency or renewable energy projects. One solution for them is to collaborate with utility companies.

Installations Have Many Ways to Collaborate with Utility Companies

Army installations collaborate with energy utilities, and that collaboration benefits both parties. For example, Fort Knox was able to reduce its absolute energy used by 58 percent in just over a decade by implementing energy efficiency and renewable energy projects primarily because of collaboration with Nolin Rural Electric Cooperative Corporation (RECC) in Utility Energy Service Contracts (UESCs). The table at right lists some of the many ways in which installations can collaborate with utility companies.

Barriers Limit Collaboration

A number of barriers hamper collaboration.

- **Lack of utility interest.** One main barrier to collaboration is that utility companies sometimes are not interested in collaborating. Reasons include lack of familiarity, staff, or expertise, and a perceived risk.
- **Lack of experienced installation staff.** A problem is a lack of a qualified, full-time energy manager. The highest pay grade for energy-related positions is usually GS-12 (or equivalent). A lack of advancement potential often contributes to frequent energy manager turnovers. Even where a full-time manager is present, often not enough trained staff are available to support that person. Installation staff also often lack technical expertise or business experience.
- **Legal and contracting staff issues.** Legal and contracting staff often are busy with other work. Some staff members also do not understand UESCs and are thus reluctant to get involved with them.
- **Renewable energy investment issues.** Renewable energy projects confront a range of issues. Cheap electricity can make renewable energy projects seem less attractive. Also, these projects are perceived to be technically riskier than other approaches. That uncertainty and the complexity and technical expertise required tend to deter staff from pursuing them.
- **Other barriers to collaboration.** Sometimes installation staff do not know about funding and contracting mechanisms other than UESC projects, such as power purchasing agreements and USCs. Lack of staff knowledge or time also hinder projects where utility companies would be interested in collaborative efforts such as on-site power, energy security, smart grid, and demand response. Installation participation in demand response has been limited because it is difficult for installations to get the proceeds.

How Installations Collaborate with Energy Companies

Method	Characteristics
Utility Energy Service Contracts (UESCs)	UESCs help finance and implement energy projects, e.g., install a more efficient boiler. Utility makes initial investment; installation pays it back, typically over 10 years.
Utility Service Contracts (USCs)	USCs provide energy distribution and transmission systems. Can be used for some energy efficiency projects.
Energy security and reliable service collaboration	Utility works with installations to ensure reliable power, including during emergencies. Includes planning for backup power and allowing on-installation power plant.
Energy audits, technical assistance	Utility provides free or fee-based audit to identify efficiency projects. Provides technical assistance for identifying, choosing, installing or operating energy efficient or renewable technologies.
Renewable energy collaboration	Utilities collaborate with installation to invest in and operate renewable energy projects and to purchase renewable energy credits. Utilities can help finance, negotiate, build, and operate on-site projects.
Utility rebate and incentive programs	Utility offers or promotes rebate programs to get customers to invest in efficient or renewable technologies.
Demand response	Utilities like to work with installations to help reduce peak demand and capacity needs. The customer agrees to short periods of decreased consumption during high-demand periods.

Ways to Overcome Barriers

While many barriers exist, there are also many ways to overcome them.

- **Motivate utility companies to collaborate.** The Army could foster more collaboration with utilities by reaching out to them more. Having a policy for installations to do so would be a good initial step, as would more engagement with utility associations. A longer payback period for UESCs, such as 30 years, would allow greater flexibility, especially for renewable energy projects.
- **Deal with staff issues.** Energy staff are critical to collaboration, and several improvements would facilitate it. One would be to ensure an adequate number of staff and allow a higher pay grade for the installation's energy manager. Installations could also employ more Resource Efficiency Managers (government contractors who have energy efficiency expertise). Issuing the new Army UESC policy and a handbook on how to do UESCs would also help.
- **Improve legal and contracting staff expertise.** Increasing the time devoted to UESCs in Army legal education would be beneficial. The Army should provide UESC training to installation staff and ensure that the new UESC policy explains the role of contracting officers and that contracting staff receive a detailed UESC handbook.
- **Make renewable energy investments.** The Army should support and document more renewable energy demonstration projects at installations, expand installation staff education, and encourage collaboration with utilities in renewable energy through policy. Support for renewable energy experiments should include research and financial and technical assessments to identify the most feasible and cost-effective renewable projects. More education and training about renewable energy options would help. Army policy and guidance should encourage more collaboration in on-site power generation, energy security, power purchasing agreements, and enhanced use leasing deals regarding renewable technologies. ■

> The Army should support and document more renewable energy demonstration projects at installations, expand installation staff education, and encourage collaboration with utilities in renewable energy through policy.

Urban Warfare: The 2008 Battle for Sadr City

KEY POINTS

- The most effective approach to the challenges of urban combat in the future may be one that sees it as a wide-area security mission rather than as a "take and clear" mission.

- Decentralized decisionmaking is crucial to counter a fleeting enemy. Information and assets need to be pushed down to brigade level and below.

- Heavy forces (tanks and infantry fighting vehicles) are key elements of the ground fight in complex terrain: they are survivable, lethal, and precise.

U rban warfare has long been seen as perhaps the most difficult and demanding military task. Recent history features two approaches to it. The experiences of Russian forces in Grozny and U.S. forces in Fallujah illustrate one approach. In each case, noncombatants were told to evacuate in advance of the attack and anyone left was a de facto enemy fighter. Then these geographically remote cities were, in effect, besieged and then stormed, with attacks supported by massive firepower. The result: high casualties on both sides and rubbled cities.

The 2008 battle for Sadr City offers a different model, in which the challenges were even more formidable than those posed by Grozny and Fallujah. Sadr City is part of Baghdad and has an estimated population of 2.4 million. Forcing noncombatants to evacuate was not an option: there was nowhere for them to go. However, the approach to ridding Sadr City of Jaish al-Mahdi (JAM) fighters was quite different from that used in Grozny or Fallujah. The operation was essentially a wide-area security operation and focused on enemy fighters and their capabilities, rather than taking and clearing the city. Thus, the battle of Sadr City offers valuable lessons for future urban operations.

The trigger for the battle was JAM's response to the Iraqi government's offensive against insurgents in Basra. JAM launched its own offensive, overrunning Government of Iraq security forces and firing rockets and mortars into the International Zone, also known as the Green Zone.

In response, a U.S. Army brigade and Iraqi security forces (army and police), featuring Abrams tanks, Bradley fighting vehicles, and Strykers, along with engineers, civil affairs, and psychological operations personnel and other support troops, took on JAM. Importantly, the command and control arrangements gave the brigade commander direct access to crucial intelligence, surveillance, and reconnaissance (ISR) assets and fire support, including attack helicopters, fighter aircraft, armed Predator UASs, and Shadow UASs. This arrangement gave the brigade commander a short decision-response time that enabled him to react promptly to JAM operations.

An early priority was to stop the rocket and mortar attacks on the International Zone. JAM could launch these attacks quickly and almost at will. It simply required pulling a vehicle into a firing position, unloading the rocket and its firing rail, firing off the rocket, and driving back to a hide position: the work of minutes. U.S. forces quickly realized that the International Zone was at the extreme end of the 107mm rocket's range. Their solution was to push JAM fighters out of their firing positions and back into Sadr City. This approach did not stop JAM infiltration. The brigade then employed an innovative but straightforward approach: It walled off two neighborhoods south of Sadr City, including the one containing the Jamilla market where JAM got much of its resources. The wall consisted of T-wall sections, each twelve feet tall and weighing 9,000 pounds. (See photo at right.) The wall became an impenetrable, nearly five-kilometer barrier that denied JAM what had been terrain and avenues of movement crucial

Building the wall under fire in Sadr City

to its operations. The fighting was particularly intense and required the brigade commander to commit Abrams tanks and Bradleys to dislodge JAM fighters and protect the soldiers building the wall.

As soon as the wall started to go up, JAM instantly recognized the threat posed to its operations and launched numerous attacks to stop its construction. The wall, in the words of one U.S. commander, became a "terrorist magnet." U.S. forces fought from a position of advantage and defeated the JAM assaults.

While the construction of the T-wall ultimately squelched the rocket attacks, by defeating JAM's fighters, U.S. forces waged an intense—and instructive—counter-fire campaign. Key to that campaign was giving the brigade commander direct access to ISR assets that he could direct almost immediately to identified firing locations without having to go through another headquarters. He could also pass intelligence rapidly and by secure communications down to the company level. He could attack enemy firing points around the clock with a formidable array of assets, including Apache helicopters, Air Force fighter aircraft, and armed Predator UASs. Brigade intelligence analysts honed their techniques over time and learned to follow JAM rocket teams to their source rather than attack them immediately. Then they could strike ammo dumps and more senior leaders, thus having a much more profound effect than they would by destroying a vehicle and a few foot soldiers.

The overall results impress. In about two months, U.S. and Iraqi forces crushed JAM, killing an estimated 700, won back significant numbers of the population, and re-established control of what had been an insurgent stronghold. U.S. killed in action numbered fewer than ten. Furthermore, the Multi-National Division Baghdad (MND-B) exploited the success of the combat gains in Sadr City with an intensive campaign of providing local security and reconstruction, all complemented by information operations.

In addition to the key lessons highlighted above, other key lessons emerged. First, persistent ISR, technical intelligence, and responsive precision strike are crucial to success, but they must be integrated at low levels. Second, ground maneuver was essential. It forced the enemy to react and enabled U.S. forces to seize control of the terrain south of Sadr City and to erect the barrier. Furthermore, capable indigenous forces were decisive in securing gains. Their presence signaled that Iraqis were in charge, not coalition forces who would eventually leave. Finally, forces must be able to transition from one type of task (counterinsurgency) to another (intense close combat) seamlessly and rapidly. ∎

> The wall became an impenetrable, nearly five-kilometer barrier that denied JAM fighters what had been terrain and avenues of movement crucial to their operations.

Identifying Civilian Labor Market Realities for Army Officers Making Stay/Leave Decisions

KEY POINTS

- Many officers overestimate the ease of finding civilian employment that offers income comparable to what they receive while on active duty and also likely underestimate the additional, less visible "costs" of leaving active-duty service.

- These costs include the possibility of unemployment, underemployment, job instability, and less generous civilian health care and retirement benefits.

- Explaining the value of health care benefits and, to a lesser extent, retirement benefits appears to have the largest potential impact on retention.

- Communication on these issues will likely require multiple channels, including one-on-one communication, distribution of written materials, and the Internet.

Despite relatively high levels of officer retention overall, Army personnel management officials have noted that junior officer retention is lowest for the individuals in whom the Army has made the largest investment, i.e., U.S. Military Academy (USMA) graduates or Reserve Officer Training Corps (ROTC) scholarship graduates. As the figure (right) shows, by the eighth year of service, USMA graduates have the lowest continuation rates of any accession source, at about 44 percent, while ROTC scholarship graduates have the second lowest rates, at about 51 percent. Officials are concerned that these officers may not have a full and accurate picture of the socioeconomic environment facing them if they leave active-duty service.

A RAND Arroyo Center report describes the socioeconomic environment that officers will encounter if they leave active-duty service and analyzes the potential impact of these factors on Army retention. The study also considers how major differences between military and civilian employment can be effectively communicated to officers making stay/leave decisions.

How Does the Socioeconomic Environment Differ for Military and Civilian Employment?

Arroyo researchers reviewed military manpower, personnel, and labor economics literatures in order to identify socioeconomic differences between military and civilian employment. Since officers understand how much they receive in their paychecks, and civilian wages and salaries are the most visible "benefit" of leaving active-duty service, researchers concentrated on differences in other areas, including unemployment and cash compensation, noncash and deferred compensation, and other characteristics of jobs.

Unemployment and Cash Compensation

Officers leaving for the civilian workforce face risks of civilian unemployment and underemployment. There is a greater possibility of involuntary separation in a civilian job, and civilian unemployment rates vary greatly over time. Officers would also face potential job instability in civilian employment. On average, civilians hold seven different jobs in the first ten years of their careers. The economics literature generally concludes that the number of jobs held by new labor market participants adversely affects earnings later in one's career. However, switching jobs can have a significant payoff for some workers who voluntarily transition from one employer to another. Officer wage growth is comparable to that of civilians, despite the fact that a significant portion of civilian wage growth is due to switching jobs. Further, comparisons of wages earned by men and women, and by white and black workers, in civilian jobs consistently show gaps between groups.

Noncash and Deferred Compensation

Military health care benefits are more generous than the benefits available to both private-sector and civil-service employees. TRICARE plans do not charge members a premium, and officers have lower out-of-pocket costs than do their civilian counterparts. Twenty percent of civilian workers and approximately ten percent of college-educated civilians are not offered any health care benefits.

The military retirement benefit is also more generous than any private-sector benefit. Forty percent of private-sector workers, and 20 to 30 percent of white-collar workers, are not offered any retirement benefits, and defined contribution plans increase uncertainty about the value of benefits. However, private-sector workers are vested in retirement systems much earlier in their careers and retain their account balances even if they leave their employer before retirement.

Officers have access to several quality-of-life programs that are typically unavailable from civilian employers, including community and family support programs, and morale, welfare, and recreation programs. However, fewer than 50 percent of service members use these programs.

FY09 Cumulative Continuation Rates, by Accession Source

Other Characteristics of Jobs

There are several aspects of employment that affect officers more than civilians and are generally thought to reduce the value of military employment, including the prevalence of geographic relocation and the potential for deployment. However, it is not clear that officers have unrealistic expectations about these differences.

How Do Expectations About the Civilian Socioeconomic Environment Affect Retention?

How the socioeconomic environment affects retention depends on service members' expectations about military and civilian compensation, not on actual compensation. Individuals base their stay/leave decisions on what they expect to happen in the future, perceptions that may or may not be accurate.

Officers probably overestimate the ease of finding civilian employment that offers income comparable to what they receive while on active duty. Since they overestimate the most visible "benefit" of civilian employment, i.e., wages, it also is likely that they underestimate the additional, less visible "costs" of leaving active-duty service. If this is the case, improving the accuracy of officer expectations will lower expectations of civilian compensation and improve officer retention.

Of the socioeconomic characteristics for which quantitative estimates of the potential impact on officer expectations about civilian compensation are available, health care benefits appear to have the largest potential impact on retention, while military retirement is expected to have more modest impacts on retention.

Communicating the Socioeconomic Differences to Officers

The analysis implies a need to strategically target USMA and ROTC-scholarship graduates. Providing information on the costs of civilian employment before these individuals receive their commissions would allow the Army to get a head start on junior officer retention at a time when these individuals are in a structured environment.

Communication will likely require multiple channels, including one-on-one communication, distribution of written materials, and the Internet. The Army is experimenting with a junior officer retention website to provide information these officers need to evaluate differences between military and civilian employment. ■
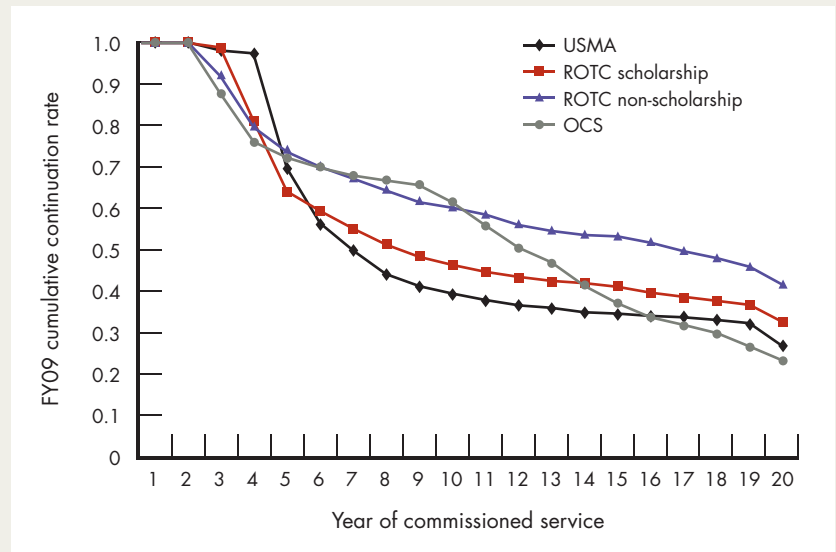
Helping the Army Better Manage Its Inventory of Organizational Clothing and Individual Equipment (OCIE)

KEY POINTS

- The Army asked RAND Arroyo Center to develop a data-driven inventory management approach for OCIE that reduces costs while maintaining high performance.

- The new policy uses data from across the supply chain to determine which items should be stocked at each Central Issue Faciity (CIF), when stocks should be replenished, and how many of an item should be ordered.

- The approach also uses data on equipment issued at CIFs to identify inventory available for transfer across CIFs.

- Arroyo is facilitating a rolling implementation of the approach across active-component CIFs in the United States, Europe, and Korea.

- The Army has estimated total savings of more than $100 million from the new approach.
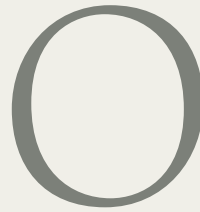
Over their careers, U.S. soldiers are issued about $8,000 to $10,000 worth of organizational clothing and individual equipment (OCIE), including helmets, gloves, body armor, duffel bags, and other gear. Active-component soldiers receive and turn in their gear at Central Issue Facilities (CIFs), which are "storefront" establishments located at or near Army installations across the United States and overseas.

From 2007 to 2009, the Army saw the value of OCIE inventory in support of active-component soldiers increase by more than 100 percent. This growth was due to a number of factors, including the introduction of new OCIE (which necessitates supporting both old and new inventory during the transition) as well as CIF managers' focus on filling every soldier's request for OCIE at the time of the soldier's first visit to the CIF, a practice that led to high performance but required a wide range of inventory to be stocked. CIF inventory managers also lacked a mechanism to signal when they should replenish inventory and how much to order.

The Army logistics leadership felt that there was an opportunity to improve CIF inventory management efficiency while maintaining strong performance and asked RAND Arroyo Center to develop a new inventory management approach. Arroyo researchers developed a methodology using data on issue and turn-in patterns over time to generate recommendations for replenishment actions and inventory levels. They also developed an approach to facilitate increased use of transfers across CIFs to draw down existing inventory while maintaining performance levels.

## A Data-Driven Approach to Inventory Management

Arroyo researchers focused on "right-sizing" the inventory at CIFs by instituting centralized management of inventory levels. They used historical issue and turn-in data from across the supply chain to determine which items should be stocked at each CIF, when stocks should be replenished from the Defense Logistics Agency (DLA) or the vendor, and how many of an item should be ordered. Researchers found that CIFs need to carry a fairly small range of items—around 425—to meet most soldier requests. Researchers then determined when inventory for each item should be replenished based on the "peak net issue," i.e., the largest net issue quantity over a replenishment lead time period (i.e., the time needed to replenish stocks from DLA or the vendor). The order quantity was determined using a classic formula that balances holding costs (e.g., opportunity costs, warehousing costs, risk of obsolescence) and ordering costs (e.g., labor costs in preparing and receiving orders, transportation costs).

Successful Pilot Test of Inventory Levels at Fort Stewart and Fort Drum

The new approach was successfully tested at Fort Stewart beginning in August 2009 and at Fort Drum in May 2010. As shown in the figure, inventory managers began ordering less after implementation of the new approach. In the 10-month period prior to implementation, the total value of replenishments was $6.6 million, while in the 10-month period after implementation, the total value of replenishments was $1.3 million, an 80 percent decrease. The value decreased to $1.2 million over the subsequent 10 months. Similarly, the value of replenishments at Fort Drum decreased by 60 percent (from $4.5 to $1.8 million) over the nine-month periods before and after the implementation of the new approach. During implementation, performance at both locations remained high—almost 100 percent of soldier requests were filled during this time. In addition to these one-time savings, the Army is achieving ongoing savings by tightening the supply chain to respond more quickly to equipment upgrades and changes in pattern.

Value of Replenishment Requisitions at Fort Stewart Decreased by 80 Percent

Total value of replenishments, per 10-month period ($M)
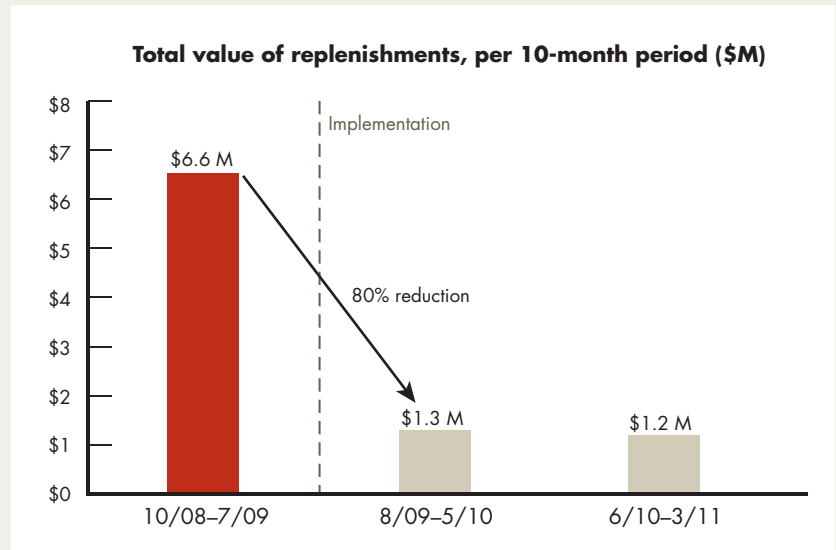
Increased Use of Transfers Across CIFs

The second part of Arroyo's approach was to facilitate an increase in transfers to make better use of existing inventory at CIFs. Transfers between CIFs can help draw down material that is in long supply at one CIF but still needed at others. Transfers have two benefits: avoiding the costs of replenishments from the vendor/DLA, and potentially improving customer response time by avoiding backorders.

Researchers used data on equipment issued at CIFs to facilitate the identification of materiel available for transfer between CIFs. In November 2010, the Army instituted a transfer pilot test with over 20 CIFs. At Fort Stewart, for example, over $7 million in inventory was identified that could be transferred to other CIFs.

Across 20 CIFs, transfers saved the Army $42 million (in addition to savings from drawing down inventory to meet local demands) by avoiding replenishment orders sent to the vendor/DLA. Plans are under way to implement the approach for increasing transfers widely. With additional automation, potential transfers will be automatically identified and prioritized.

From 2007 to 2009, the Army saw the value of OCIE inventory in support of active-component soldiers increase by more than 100 percent.

The Army Is Implementing the New Inventory Approach Widely

To date, the Arroyo team has made over two dozen site visits to CIFs to help institutionalize the new inventory approach for OCIE. It is facilitating a rolling implementation of the approach across Army facilities in the United States, Europe, and Korea.

The Army Estimates Savings of More Than $100 Million

The Army has estimated total first-year savings of $100 million from implementation of the improved inventory approach and an additional $30 million per year for the next five years. The new methodology is being transferred to the Army and written into Army Regulations (AR 710-2).

RAND Arroyo Center is continuing to help the Army manage its inventory of OCIE. Ongoing research will focus on:

- Improving coordination across the supply chain, including DLA and vendors.
- Optimizing the use of regional warehouses for repair, laundry, and centralized stocking of low-demand inventory. ■

What's the Potential for Conflict with China, and How Can It Be Avoided?

KEY POINTS

- Even as China becomes a near peer competitor, armed conflict between China and the United States will be unlikely.

- To ensure this, the United States must retain its deterrent capacity and bolster the capabilities and resolve of other regional states.

- Should conflict with China occur, the economic consequences would be historically unparalleled.

- A collapse of the Democratic People's Republic of Korea is the most likely East Asia contingency, and U.S. ground forces will be essential to address it.
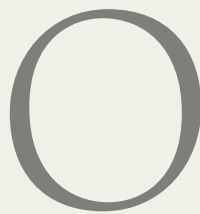
Over the next 20 years, China's gross domestic product and defense budget could exceed those of the United States, making it a true peer competitor. Despite this potential, China's security interests and military capabilities will remain focused on its immediate periphery. China does not appear interested in matching U.S. military expenditures, achieving a comparable global reach, or assuming defense commitments beyond its immediate sphere. As a result, armed conflict between the United States and China is unlikely.

Chinese Regional Capabilities

Although China's overall military capabilities will not equal those of the United States any time soon, it will more quickly achieve local superiority, first in and around Taiwan and then at somewhat greater distances. Consequently, the direct defense of contested assets in that region will become progressively more difficult, eventually approaching impossible. Relations between China and Taiwan have improved, but the core issue of the island's ultimate status—independent or part of a unified China—remains unresolved. The chance of a cross-strait conflict will persist so long as this fundamental disagreement exists. A conflict could take many forms, from blockade to outright invasion.

Should the United States get involved, it would want to preclude conquest of Taiwan and limit damage. Direct defense is presently feasible. Precluding the Chinese from dominating the air or sea and limiting the damage from land attack missiles, perhaps by mainland strikes, would be core missions. Chinese military modernization programs will erode U.S. ability to accomplish these missions. Over time, China will be able to expand and extend its anti-access capabilities. In addition, Chinese cyber and anti-satellite capabilities may eventually be able to disrupt U.S. command, control, and intelligence capabilities, which, given U.S dependence on them, could make direct defense far more difficult.

Managing Escalation and Retaliation

The United States will therefore increasingly depend on escalatory options for defense and retaliatory capabilities for deterrence. U.S. nuclear superiority is not likely to help in this regard, both because China will retain a second-strike capability and because the issues at stake in most potential crises are not of vital consequence to the United States.

The possibility of escalation is high. Armed conflict with China would be likely to escalate into the cyber and economic realms. In both cases, U.S. vulnerabilities are such as to make this eventuality unattractively costly. Conventional strikes on mainland Chinese military targets may be the best escalatory option, but there is little reason to be confident that conflict could be so confined.

A U.S.-China conflict might also break out in—and perhaps be confined to—cyberspace. Cyber war might be an overture to armed hostilities, or the conflict could remain there. Escalation within cyberspace could take the form of efforts to penetrate sensitive networks such as intelligence. If warning networks were breached, the United States might retaliate against networks that affect Chinese trade, which could lead to escalatory attacks such as "soft kill" of satellites.

Using Coalitions and Cooperation

While armed conflict between the United States and China is not probable, that judgment assumes that the United States will retain the capacity to deter behavior that would lead to a clash. The United States should also enable the capabilities and buttress the resolve of China's neighbors. Such a strategy should not be—or be seen—as a U.S. attempt to encircle or align the region against China, lest it provoke greater Chinese hostility. A parallel effort should be made to draw China into cooperative security endeavors, not only to avoid the appearance of an anti-China coalition but also to obtain greater contributions to international security from the world's second-strongest power.

Should a Sino-American conflict occur, the economic consequences could be historically unparalleled, even if both sides avoid economic warfare. This is a powerful mutual deterrent, one that tilts marginally in U.S. favor at present. Strengthening the U.S. economy is the best way of ensuring that the balance of interdependence and of the associated deterrence does not shift dangerously against the United States over the next several decades.

Other Potential Conflicts in East Asia

Conflicts in the region involving nations other than China are more likely. Possible conflicts might arise on its periphery involving Korea, Taiwan, one or more countries of Southeast Asia, or India, roughly in that descending order of probability. These more likely conflicts will be with opponents quite different from China and will call for capabilities quite dissimilar from those required to deal with a real peer competitor. Individually, these contingencies will be less consequential than a conflict with China, but collectively they will shape the international environment in which both countries interact and fundamentally influence Chinese perceptions of U.S. power and resolve.

U.S. ground forces will be essential for the most likely East Asia contingency, that arising from a collapse of the Democratic People's Republic of Korea (DPRK), but less so for the others. Collapse of the DPRK would require substantial U.S. ground forces, with a primary goal of securing ballistic missile launch and weapons of mass destruction sites. The possibility of confrontations between U.S. and Chinese forces would be high, and any confrontations would carry with them significant potential for escalation. ■

> Although China's overall military capabilities will not equal those of the United States any time soon, it will more quickly achieve local superiority, first in and around Taiwan and then at somewhat greater distances.

Achieving Efficiencies Through a Rotational Equipping Strategy

KEY POINTS

- Long-term commitments to Iraq and Afghanistan have caused the Army to employ a rotational strategy for its units.

- However, it still provides units with all their equipment, even though some have years between deployments.

- A rotational equipping strategy reduces the amount of equipment units have in the early phases of the ARFORGEN cycle, thus enabling reductions in overall equipment authorizations.

- Such a strategy could reduce costs by $5–$10 billion from FY12 and beyond.

The long-standing conflicts in Iraq and Afghanistan have prompted U.S. Army leaders to alter the ways units are made ready to fight. Following the 2006 Army Force Generation (ARFORGEN) model, readiness is built over time as units progress through a three-part cycle of unit training, unit deployment, and recovery and individual training. While early steps have been taken to equip units according to this new management structure, further changes in equipping policies are needed as DoD budgets continue to tighten and the wars begin to wind down.

A 2011 RAND Arroyo Center study sought to help the Army meet new equipping challenges by constructing a fast-running analytic model to simulate the deployment of units and the allocation of equipment to units according to the new ARFORGEN cycle. From the model, Arroyo researchers were able to determine whether equipment levels could be reduced at any point in the rotational management cycle while not hindering the Army's ability to conduct critical operations and meet goals.

New Deployment Schedules and Old Equipping Methods May Produce Excess

Current methods of equipping soldiers, like former ways of managing units, are based primarily upon outdated principles of *tiered* readiness. During the Cold War era, the Army was structured for mass mobilization. Multiple tiers of forces were prepared to act where and when needed: top tiers were ready to deploy at a moment's notice, and other tiers were ready to follow in support. Army equipping policy still reflects the tiered tradition in that it aims to provide units with 100 percent of their equipment at all times, deployed or not. Moreover, equipment issued to a particular unit remains in that unit until it becomes unusable or obsolete.

The rotational ARFORGEN schedule does not necessarily require that all units be fully and constantly equipped. As units circulate through the rotation, different levels of readiness are warranted. When units are deployed, they must have all of their wartime requirements. However, when they return, during the *reset* phase of rest and individual training, they may need far less equipment. As units move to group training in the *ready* phase, they may then begin to pick up equipment to meet preparatory needs.

The Arroyo Rotational Equipping Model enabled researchers to analyze how rotational equipping might affect Army inventory requirements by taking force structure, equipping demands, and rules of how units rotate through the ARFORGEN cycle and producing minimum (called "rotational low") and maximum ("rotational high") equipping levels for both long-term steady-state and surge deployments.

Rotational Equipping Can Trim Army Budget

The Arroyo team found that inventories of required or high-end items could be reduced by 25 percent if equipment were rotated in closer accordance with the ARFORGEN cycle. Substantial savings can be gleaned from these reductions. For example, it is estimated that upgrades of the Army's fleet of AH-64 Apache helicopters through 2015 could cost the Army $8.5 billion, with an additional $2.2 billion put toward building new Apaches. The rotational equipping strategy, however, would cut the total platforms by 11 to 29 percent overall, and thus reduce both near-term new purchases and mid- and far-term upgrades. The table below shows the magnitude of savings that this strategy can deliver for three systems: Apaches (AH-64s), Chinooks (CH-47s), and Paladins (M109s). In total, the team estimated that the Army could save between $5 and $10 billion on new purchases and upgrades in top procurement programs, with additional savings if the rotational equipping strategy were applied widely.

> Inventories of required or high-end items could be reduced by 25 percent if equipment were rotated in closer accordance with the ARFORGEN cycle.

Rotational Equipping Would Involve Major Changes

To realize large cost savings from rotational equipping, the Army must change equipping policy substantially and take an enterprise approach. A rotational equipping strategy would affect Army culture and force management in three ways:

- **The status quo is challenged.** Unit commanders would need to accept lower equipping levels. Unlike legacy equipping policies in which units were allotted 100 percent of their equipment, the Army will need to reduce the equipment that units have in their reset and ready phases. Units will have access to only a small amount of equipment in early phases, and then progressively more as they move toward deployment.

- **Units will need to manage equipment differently.** The Army will need to enhance the flexibility of equipment sharing policies and practices among units. Units will have to receive and return equipment as they move through different phases, and units will have to be able to push larger amounts of equipment to deployed forces during surges.

- **Rotational equipping goals will need continual appraisal.** The study relied on certain assumptions drawn from current Army demands and future projections. However, the specific allocation of resources against these goals should always reflect current Army priorities. As operational forecasts and equipping realities change, goals will need to be readdressed and equipping management procedures will need to be updated quickly.

In summary, this study demonstrates how the Army might have numerous opportunities to reduce future budgets and bring the equipping strategy more in line with personnel policies. Moving forward, however, the Army should consider the significant changes a rotational equipping strategy will elicit throughout the force and DoD. ∎

Savings/Avoidance for Three Systems Under a Rotational Equipping Strategy

System/ Approach	Total MTOE + TDA + APS	Rotational Low	Savings/ Avoidance $B	Rotational High	Savings/ Avoidance $B
AH-64D Cut upgrades	772	550	1.5	688	.03
AH-64D No new buy			3.0		.115
CH-47	404	368	1.5	398	
M109	616	454	0.5	567	N/A [a]

[a] The number of upgraded systems is lower than the total in the rotational high option.

MTOE = Modification Table of Equipment; TDA = Table of Distribution and Allowances; APS = Army Prepositioned Stocks.

The Army Fellows cohort of 2011–2012, including
Left to right (front): LTC Takako Barrell, MAJ Steven Knapp, LTC Michael Giglione, MAJ Tim Vail, LTC Britt Walker,
Left to right (rear): Arroyo Center Director Tim Bonds, MAJ(P) Roy Speaks, MAJ Kirk Windmueller, LTC Andrew Ajamian, LTC Ed Weinberg.

Education and Training of Army Officers

- Lieutenant Colonel Michael Giglione

- Lieutenant Colonel Takako Lei Barrell

- Lieutenant Colonel Andrew Ajamian

- Lieutenant Colonel Britt Walker

- Lieutenant Colonel Ed Weinberg

- Lieutenant Colonel Roy Speaks

- Major Kirk Windmueller

- Major Steven Knapp

- Major Tim Vail

Education and Training of Army Officers

Among the research products and services that RAND Arroyo Center provides to the Army is the education and analytic training of Army officers. This educational function reflects RAND's goal, stated in its 1948 Articles of Incorporation, to "further and promote scientific, educational, and charitable purposes, all for the public welfare and security of the United States of America." RAND's institutional commitment to education gives Army officers the unique opportunity not only to work side by side with RAND analysts but also to engage with officers from other military services who are also at RAND participating in visiting analyst programs.

Army Fellows Program

Each year the Army selects a number of majors and lieutenant colonels to work at Arroyo as visiting analysts in the Army Fellows Program.[5] This program affords officers the opportunity to increase their analytical capabilities through participation on Arroyo studies addressing critical policy issues faced by the Army. In turn, their participation enhances Arroyo staff's understanding of current Army policies. The one-year fellowship is followed by a three-year utilization assignment on a senior-level Army or Joint staff.

To date, 177 officers have participated in the program. Nine officers participated in the program in the 2011–2012 cohort.

2011–2012 Army Fellows

Lieutenant Colonel Michael Giglione was most recently assigned as the operations officer (S-3) of the U.S. Central Command Army Reserve Element (ARE) in Tampa, Florida. He has served at the U.S. Army Intelligence and Security Command in the G-3 section, Third U.S. Army in the C-3 Plans section, the U.S. Army Network Enterprise Command in current operations, and on multiple counterdrug tours as an analyst with Joint Task Force Six. LTC Giglione is a graduate of the U.S. Army Command and General Staff Officer Course (resident), Military Intelligence Captains Career Course, and Signal Officer Advanced Course, and he has completed master's programs in strategic intelligence (including denial and deception) and information technology management. His deployments include Kuwait, Iraq, and Bosnia, and he was a certified multi-engine, instrument flight instructor before entering active duty as an Active Guard Reserve officer. As an Army fellow, LTC Giglione contributed to studies on military intelligence human capital, strategy and resourcing analysis, and an assessment of the National Intelligence University.

Lieutenant Colonel Takako Lei Barrell is a critical care nurse who most recently served as the Deputy Commander for Nursing at the Medical Department Activity in Japan. Previous assignments include serving as the personnel management officer at Human Resources Command, Intensive Care

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Unit head nurse with the 86th Combat Support Hospital (CSH) in Iraq, Company Commander of Special Troops Battalion at Fort Sam Houston, combat medic instructor at Army Medical Department Center and School, and 212th MASH ICU head nurse in Germany. LTC Barrell holds a master's degree in health care administration and a bachelor's degree in nursing. As an Army fellow, LTC Barrell contributed to studies on Army Military Education Level (MEL) 1/Senior Service College requirements; the future of the Army Medical Department's Professional Filler System; Troops to Nurse Teachers program; recruiting process for medical/dental professionals; health care and transition for wounded, injured, and ill soldiers; and assessing value and efficiency in the Military Health System.

Lieutenant Colonel Andrew Ajamian is an Army strategist and was most recently assigned as a branch chief of a team responsible for developing insights for senior Army leaders in the Chief of Staff of the Army's annual Title 10 future study (Unified Quest) in the Army Capabilities Integrations Center at Fort Monroe, Virginia. Prior assignments include Commander, Headquarters and Headquarters Company, and Chief of Plans in U.S. Army South; and Strategic Plans Officer at Camp Arifjan, Kuwait. Prior to becoming an Army strategist, LTC Ajamian served as an assistant professor of military science, infantry company commander; infantry battalion assistant S3; armor task force S4; platoon leader of light infantry, mechanized infantry, and anti-tank platoons; and infantry scout in the Pennsylvania National Guard. He holds a bachelor of arts degree in political science from Indiana University of Pennsylvania and a master of arts degree in management from the University of Alabama. As an Army fellow, LTC Ajamian contributed to studies on the future strategic environment, future Army force requirements, future joint operational concepts, and the career development of soldiers in the Civil Affairs branch.

Lieutenant Colonel Britt Walker is an operations research systems analyst (ORSA) who most recently served as the Chief of Wargaming for the U.S. Special Operations Command, MacDill Air Force Base, Florida. Previous assignments include serving as a test and evaluation officer with the U.S. Army Special Operations Command (USASOC), chief of operations with the 1st Corps Support Command, deployments to Iraq and Kosovo, and service in Europe, Korea, and the contiguous United States. Prior to becoming an ORSA, LTC Walker served as a parachute rigger platoon leader, battalion S-3, division Class IX officer, and quartermaster company commander. LTC Walker holds an MBA in logistics management from the University of Tennessee and a bachelor of science degree in criminology from Florida State University. As an Army fellow, LTC Walker contributed to studies on USASOC's Tactical Human Optimization, Rapid Rehabilitation, and Reconditioning (THOR3) and Lessons Learned programs as well as psychological health and traumatic brain injuries initiatives.

Lieutenant Colonel Ed Weinberg is a health care administrator who most recently served as the Executive Officer and Chief, Research Support Division, at the U.S. Army Research Institute of Environmental Medicine in Natick, Massachusetts. Previous assignments include serving as the Deputy Commander, 28th Combat Support Hospital, Iraq; Deputy Commander, Dunham Health Clinic, Carlisle, Pennsylvania; Army Legislative Liaison, Pentagon; and numer-

On January 12, 2012, Roy Speaks was promoted to the rank of lieutenant colonel at a ceremony hosted by RAND Arroyo Center deputy director Bruce Held. COL Mark Braisted, RAND Air Force Fellow, was the presiding officer, and CDR Todd Trimpert, RAND Coast Guard Fellow, administered the reaffirmation of the oath of office. LTC Michael Giglione, senior Army Research Fellow, assisted in the ceremony and requested publishing of the promotion order. LTC Speaks's spouse, Catherine, and son, Mason, pinned the silver oak leaf to each shoulder epaulet.

ous command and staff positions in various field and fixed facility assignments. LTC Weinberg holds a master of health care administration degree from Baylor University and a bachelor of science degree in criminology from Florida Southern College. As an Army fellow, LTC Weinberg contributed to studies on wounded warriors, defining value in the military health care system, health information technology, and the effects of Boots on the Ground (BOG)/Dwell time on behavioral health.

Lieutenant Colonel Roy Speaks was most recently assigned to the Army Command and General Staff College. His prior operational assignment was logistics planner for I Corps and U.S. Forces Iraq, J35; responsibilities there included the planning for responsible drawdown of forces and equipment from Iraq, the U.S. Equipment Transfer to Iraq, and base closure/realignment in support of Operation New Dawn. Prior assignments include support operations officer, 1st Special Forces Group, Fort Lewis, Washington; logistics planner for U.S. Army Special Operations Command; and J4, Joint Special Operations Task Force–Philippines. He holds a bachelor's degree in psychology, an MBA, and a master's degree in business–supply chain management from the University of Kansas. At RAND, LTC Speaks contributed to studies on sustainment to unconventional warfare, war reserve secondary items, and the lead material integrator's decision support tool.

Major Kirk Windmueller most recently served as the executive officer for 4th Battalion, 1st Special Warfare Training Group (Airborne). Other assignments include Charlie Company commander, 4th Battalion, 1st Special Warfare Training Group (A); Combined Forces Special Operations Component Command-A J35 in Afghanistan as village stability project officer; Special Forces doctrine chief, The U.S. Army John F. Kennedy Special Warfare Center and School; and Operational Detachment Alpha commander in 3rd Battalion, 10th Special Forces Group (Airborne), with operational deployments to Kosovo and Iraq (Operation Iraqi Freedom I and II). MAJ Windmueller earned a bachelor of science in biology at The Citadel and a master of science in defense analysis at the Naval Postgraduate School. As an Army fellow, he contributed to studies on security force assistance, an assessment of Afghan security forces, an Army force structure assessment, and the U.S. Army Special Operations Command Lessons Learned program.

Major Steven Knapp was most recently assigned as the preventive medicine officer for Task Force 115, Camp Dwyer, Afghanistan. His other assignments include Chief of Public Health, Wiesbaden Army Health Clinic in Wiesbaden, Germany; Chief of Preventive Medicine for the Army Public Health Command in Camp Zama, Japan; Reserve Officers' Training Corps nurse recruiter covering New England and upstate New York; community health nurse in Landstuhl, Germany; and staff nurse in Yongson, Korea. He holds a bachelor of science in nursing, a master of public health, and a master of science in nursing.

Major Tim Vail is an engineer officer and certified project management professional who most recently served as the S3, Operations Officer, 2nd Combat Engineer Battalion, during Operation Enduring Freedom, Afghanistan. Previous assignments include serving as the Deputy Arabian Gulf Regional Engineer for the Army Corps of Engineers, Senior Battlestaff Trainer/Observer Controller at the National Training Center, and Combat Engineer Company Commander (DIV CAV) in South Korea. Prior to that, MAJ Vail served in various platoon and battalion leadership positions in the 4th Infantry Division during the Force XXI Campaign. MAJ Vail holds a master's degree degree in construction management from Texas A&M University, a master's degree degree in environmental engineering from Missouri University of Science and Technology, and a bachelor's degree in engineering and environmental sciences from the University of Notre Dame. As an Army fellow, MAJ Vail contributed to studies on autonomous robotics; small unit effectiveness; Chief of Staff, Army 2020 Study Plan; anti-access/area denial operations; and counter unmanned aerial systems developments. ◼

Selected Researcher Profiles

- Marygail Brauner
- Frank Camm
- Gary Cecchine
- Beth Lachman
- Matthew Lewis
- K. Scott McMahon
- Sarah Meadows
- Karl Mueller
- Joel Predd
- Rajeev Ramchand
- Pete Schirmer
- Thomas Szayna

Marygail Brauner is an operations researcher who works primarily in RAND Arroyo Center's Military Logistics Program. In FY11 Dr. Brauner co-led a joint RAND-AMSAA (Army Materiel Systems Analysis Activity) study on inventory turns to support the Army Materiel Command's "war on excess" inventory. Dr. Brauner co-authored the recent Arroyo publication *Using Field Data to Improve Authorized Stockage List Push Packages* (www.rand.org/t/DB619).

Prior to joining RAND, Dr. Brauner taught quantitative methods at California State University, Northridge. She earned her doctorate in engineering and master and bachelor of arts in mathematics from the University of California at Los Angeles.

Dr. Brauner has served on the Army Science Board, receiving the U.S. Army's Commander's Award for Public Service for her service as chair of numerous studies.

Frank Camm is a senior economist who works in RAND Arroyo Center's Strategy, Doctrine, and Resources Program. In FY11, Dr. Camm led Arroyo studies on "Clarification of the Level of Army Overhead" and "How Major Changes in the Operating Force Should Affect the Size and Structure of the Generating Force." With Wade Markel, he co-led an Arroyo study on "Assessing the Army Generating Force." Dr. Camm co-authored the recent Arroyo publication, *What the Army Needs to Know to Align Its Operational and Institutional Activities* (www.rand.org/t/MG530).

Dr. Camm came initially to RAND directly from graduate school. Prior to rejoining RAND in 1985, he was a senior economist at the American Petroleum Institute in Washington, D.C. He earned his doctorate and master's degrees in economics from the University of Chicago and his bachelor's degree in economics from Princeton University. Dr. Camm has served on numerous government panels, including the congressionally mandated Commercial Activities Panel and the official U.S. delegation to the United Nations Environment Programme conference on stratospheric ozone depletion.

Gary Cecchine is a senior natural scientist who leads and contributes to research across RAND Arroyo Center and other RAND divisions. He also serves as the liaison between Arroyo and the Army G-3/5/7. Dr. Cecchine recently co-led a study of the military response to the 2010 Haiti earthquake, building upon his prior research on the Hurricane Katrina response and defense support to civil authorities. He is currently supporting a commission on Army transformation and contributing to research about the costs of ARFORGEN. He is the co-author of *Hurricane Katrina: Lessons for Army Planning and Operations* (www.rand.org/t/MG603).

Prior to joining RAND in 1999, Dr. Cecchine was a management systems consultant to several Fortune 500 companies. He earned his doctorate in biology and public policy from the Georgia Institute of Technology, and his bachelor of science in marine science and biology from the University of Tampa. He resigned his regular Army commission from the Medical Service Corps as a captain in 1994.

Beth Lachman is a senior operations research analyst with over 25 years of experience at RAND, specializing in military installation, energy and environmental management, technologies, and sustainability. She works in multiple Arroyo programs, including the Military Logistics Program and the Force Development and Technology Program. Currently, Ms. Lachman is leading an Arroyo project assessing how to effectively leverage industry investments for strategic installation activities and co-leading a project with John Matsumura on assessing new energy technologies to meet future Army installation needs. Recently, she led an Arroyo project to identify trends external to the Army that may affect the Army's ability to provide quality installation services and infrastructure out to 2025. She also recently co-led a project with John Winkler to examine the need for soldier and family support during multiple and lengthy deployments and how installation support could be adjusted to better meet this need. Ms. Lachman was the lead author on the recent Arroyo monograph *Making the Connection: Beneficial Collaboration Between Army Installations and Energy Utility Companies* (www.rand.org/t/MG1126).
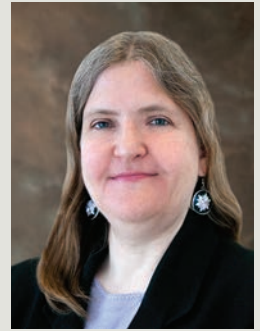
She earned her master's degree in operations research from Stanford University and a bachelor's degree, with distinction, in operations research and industrial engineering from Cornell University.

Matthew Lewis, a senior behavioral scientist, has worked on a variety of projects in RAND Arroyo Center. In FY11 Dr. Lewis led a project to understand and begin to quantify the costs and benefits of innovative, "lean" equipping strategies: meeting Army commanders' equipment needs for training and readiness while also minimizing the costs of moving equipment between units. Dr. Lewis also worked on a project that sought to safely reduce Army inventory levels of repair parts and another effort to understand the implications of integrating autonomous robotics into Army units. A recent Arroyo publication, *New Equipping Strategies for Combat Support Hospitals* (www.rand.org/t/MG887), describes lean equipping approaches and was featured prominently in the FY11 U.S. Army Medical Department's equipping strategy.

Dr. Lewis was a research faculty member at Carnegie Mellon University prior to joining RAND and also helped found software companies before and between two tenures at RAND. He earned his doctorate and master's degree in cognitive psychology from Carnegie Mellon University and a bachelor's degree in developmental psychology (and a teaching credential) from the University of California, San Diego.

K. Scott McMahon is a senior defense research analyst and serves as RAND Arroyo Center's liaison to the Army's G-8 staff. In this capacity, Mr. McMahon works to raise Arroyo's visibility among the G-8 staff and to ensure that its research products and staff are made available to support the G-8's needs. During FY10 Mr. McMahon conducted field research in Iraq to generate lessons learned from the drawdown of U.S. forces from Iraq. He contributed to an assessment of the sociocultural capabilities that commanders require across all phases of military operations, existing capability gaps, and mitigation options. He also contributed an analysis of alternative rotation rates for the regular Army, a quick-response study for the G-8. Mr. McMahon earned a bachelor of arts from Tulane University and master of arts in international relations from the American University's School of International Service.

Prior to joining RAND in 2001, Mr. McMahon served on the professional staff of the U.S. House Select Committee on China and as a national security analyst at the Pacific-Sierra Research Corporation, a firm founded by former RAND researchers in 1971.
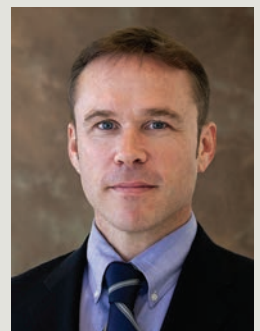
Sarah Meadows is a social scientist who works in RAND Arroyo Center. She is an associate director of the Center for Military Health Policy Research. In FY11 Dr. Meadows led an Arroyo project on the optimal mix of cadre and staffing, scholarships, and operational funding necessary for the Army ROTC program to meet its commissioning and diversity goals. Dr. Meadows is also co-leading a longitudinal study of soldiers and their families over the course of the deployment cycle that is designed to identify the antecedents and consequences of family readiness. She was a co-author of *Sexual Orientation and U.S. Military Personnel Policy: An Update of RAND's 1993 Study* www.rand.org/t/MG1056).

Prior to joining RAND in 2008, Dr. Meadows was a postdoctoral research fellow at the Bendheim-Thoman Center for Research on Child Wellbeing at Princeton University. She earned her doctorate and master of arts degree in sociology from Duke University, and her bachelor's degree in psychology and sociology from the University of Virginia.

Karl Mueller is a senior political scientist and serves as the associate director of RAND Arroyo Center's Strategy, Doctrine, and Resources Program. In FY10, Dr. Mueller led an Arroyo study examining the emerging concept of hybrid warfare and its potential relevance to the Army as it prepares for future contingencies. Dr. Mueller co-authored the Arroyo publication *Conventional Coercion Across the Spectrum of Operations: The Utility of Military Force in the Emerging Security Environment* (www.rand.org/t/MR1494).

Prior to joining RAND in 2001, Dr. Mueller was a professor of comparative military studies at the U.S. Air Force's School of Advanced Air and Space Studies (SAASS) at Maxwell Air Force Base, Alabama. He earned his doctorate in politics from Princeton University and his bachelor of arts degree in political science from the University of Chicago. Dr. Mueller also serves as an adjunct professor in the Security Studies Program at Georgetown University.

Joel Predd is an engineer who works in RAND Arroyo Center's Force Development and Technology Program. In FY11, Dr. Predd co-led a study with Bryan Hallmark and Bruce Held that considered how the Army can mitigate consequences of degraded tactical networks on mission command. Also in FY11, Dr. Predd contributed to an ASA(ALT)-sponsored analysis of options to improve aerial surveillance and reconnaissance available to dismounted patrols in Afghanistan. Dr. Predd earned his doctorate and master's degree in electrical engineering from Princeton University and his bachelor's degree in electrical engineering from Purdue University. Dr. Predd also conducts research for clients of the RAND National Defense Research Institute and RAND Project AIR FORCE; recent projects have considered implications of open architecture business models on the Navy's Aegis weapon system and the capacity of the Air Force munitions industrial base to meet unplanned production requirements.
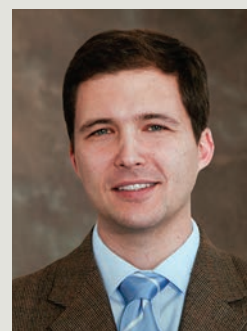
Rajeev Ramchand is a behavioral scientist at RAND and an associate director of the RAND Center for Military Health Policy Research. Dr. Ramchand was a summer associate in RAND in 2004 and joined as research staff in 2006. He is the co-author of *The War Within: Preventing Suicide in the U.S. Military* (www.rand.org/t/MG953).

Prior to joining RAND, Dr. Ramchand worked at The Urban Institute and Avalere Health, a health care consulting firm. He earned his doctorate in public health from Johns Hopkins University, and his bachelor of arts in economics from University of Chicago. Dr. Ramchand serves as Chair of the Publications Committee for the College on Problems of Drug Dependence, and is also a member of the American Public Health Association and American Association of Suicidology.
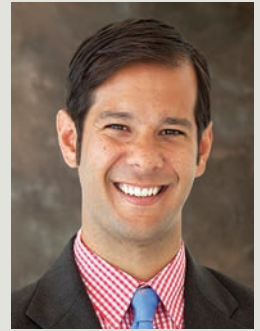
Pete Schirmer is the Associate Director of RAND Arroyo Center's Manpower and Training Program. In FY11 Mr. Schirmer led ongoing research for the Office of the Secretary of Defense (Personnel and Readiness) examining a range of personnel management issues for active and reserve component military officers. He also co-led, with Mike Thirtle, a high-level review of organization, governance, and policy related to management of Army civilians. The study was a direct request from Hon. Thomas Lamont, Assistant Secretary of the Army (Manpower and Reserve Affairs). Mr. Schirmer co-authored the recent Arroyo publication *Developing U.S. Army Officers' Capabilities for Joint, Interagency, Intergovernmental, and Multinational Environments* (www.rand.org/t/MG990).

Prior to joining RAND in 2002, Mr. Schirmer was a research analyst at MCG Capital Corporation, a NASDAQ-listed private equity firm. He earned an MBA from Georgetown University, a master of public policy from the University of Michigan, and a bachelor of arts in political science and Latin American studies from the University of Kentucky.
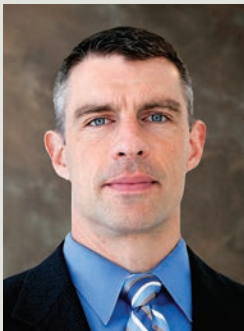
Thomas Szayna is a senior political scientist who works in RAND Arroyo Center's Strategy, Doctrine, and Resources Program. In FY 2011 he co-led two projects. One dealt with developing modeling tools suitable for irregular warfare and focused on Afghanistan. The second project examined ways to improve Army security cooperation planning processes and included developing a methodology to forecast future demand for Army forces for security cooperation. Mr. Szayna's long-standing interests include tools for policy planning and decision support, global strategy and Army forces, and stability and counterinsurgency operations. He co-authored the recent RAND monograph *Integrating Civilian Agencies in Stability Operations* (www.rand.org/t/MG801).

Mr. Szayna joined RAND in 1991, after several years of being associated with RAND as part of a Ph.D. program in the UCLA/RAND Center for Soviet Studies. He earned a master's degree in international relations from Claremont Graduate School and a bachelor's degree in history and philosophy from Villanova University. He was the recipient of a 2005 RAND Gold Award for outstanding contributions to furthering RAND's mission of improving policy and decisionmaking through research and analysis.
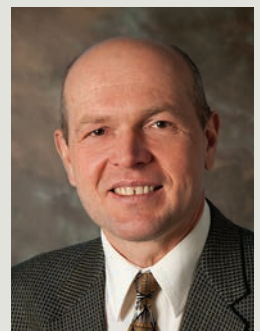
The RAND Corporation is a nonprofit institution that helps improve
policy and decisionmaking through research and analysis.

RAND Standards for High-Quality Research and Analysis

■ The problem should be well formulated, and the purpose of the study should be clear.

■ The study approach should be well designed and executed.

■ The study should demonstrate understanding of related studies.

■ The data and information should be the best available.

■ Assumptions should be explicit and justified.

■ The findings should advance knowledge and bear on important policy issues.

■ The implications and recommendations should be logical, warranted by the findings, and explained thoroughly, with appropriate caveats.

■ The documentation should be accurate, understandable, clearly structured, and temperate in tone.

■ The study should be compelling, useful, and relevant to stakeholders and decisionmakers.

■ The study should be objective, independent, and balanced.

For more information, see www.rand.org/standards

As the Army's federally funded research and development center for studies and analyses, RAND Arroyo Center is charged with helping the leadership of the Army meet its most critical challenges by providing high-quality, objective research and analysis to support decisionmaking. This annual report describes Arroyo's research activities in FY 2011. It provides an overview of the FY 2011 research agenda, including quick-response analyses conducted in response to urgent problems; features summaries of noteworthy studies that illustrate the agenda's breadth; and profiles selected researchers. The report covers the full range of research products and services that Arroyo provided to the Army, including peer-reviewed publications and the education and training of officers in the Army Fellows Program.

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